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THE WAPATO LAKE DRAINAGE PROJECT

BY W. D. PEASLEE.

ELECTRIC DISTRIBUTION STANDARDS IN SAN DIEGO

BY L. M. KLAUBER.

CORRESPONDENCE FILING CLASSIFICATIONS

REPORT ON INDUCTIVE INTERFERENCE

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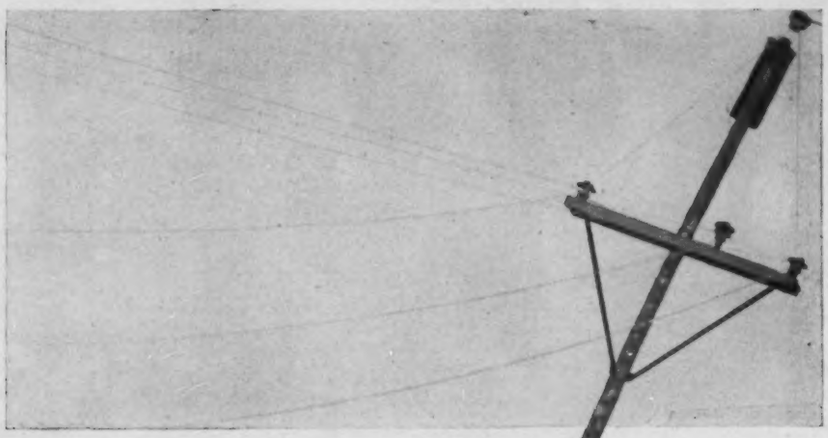

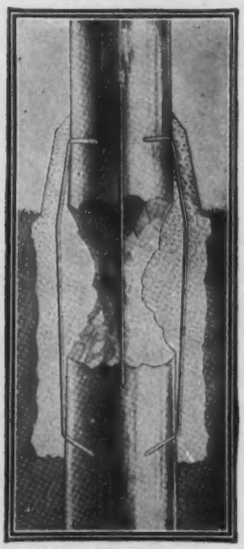

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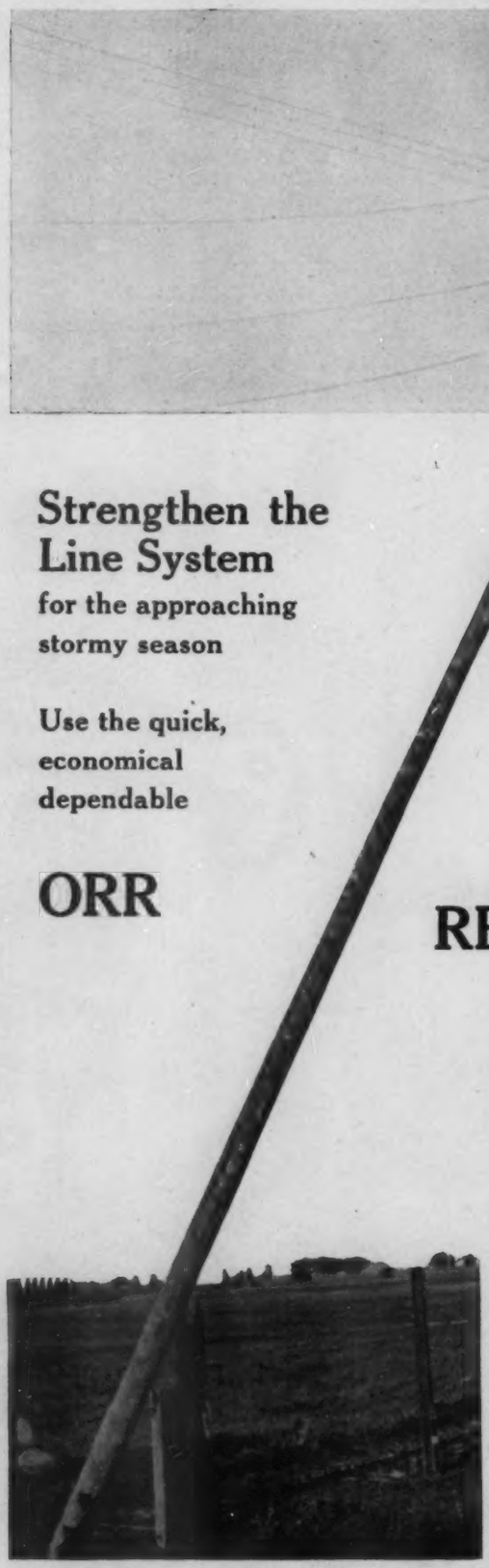

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POWER AND GAS
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VOLUME XXXIII SAN FRANCISCO, SEPTEMBER 12, 1914 NUMBER 11

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THE WAPATO LAKE DRAINAGE PROJECT

BY W. D. PEASLEE.

(After a discussion of the peculiar drainage problems presented the author shows that a synchronous motor was best adapted to meet the difficulties. Details of the motor pumping installation and of the power contract are then given. Mr. Peaslee is consulting engineer at Portland, acting for the drainage company.—The Editor.)

One of the most recent applications of electric driven pumps to the reclamation of partially or wholly flooded land has just been installed by the Gaston Gardens Company, of Portland, Oregon, at Wapato Lake, about 30 miles southwest of Portland, on the line of the Portland, Eugene & Eastern Railway.

This lake was formed by beavers building a dam across a narrow part of the valley, flooding some 800 acres. The lake gradually filled with decaying grasses and other vegetation until today the valley is covered with a layer of this deposit varying from 4 to 35 ft. thick, the soil being classed by the Oregon Agricultural College as first class "beaver dam."

Fig. 1. Wapato Lake at Time of April High Water.

Fig. 2. Wapato Lake at Time of Summer Low Water.

Before the installation of the present equipment the lake was flooded until late in the spring and it was impossible to plant crops until after the first of June, except in the few high parts around the edges. Fig. 1 shows the condition of the lake in April. High water was again encountered early in the fall, ruining the crops before they could be harvested, and all attempts to farm the projects had resulted more or less disastrously.

The Gaston Gardens Company, realizing the value of the land if it could be kept dry, acquired it and began a systematic campaign of reclamation. A large canal was dug, widening the natural stream that flowed

through the property, and laterals dug at frequent intervals provided thorough drainage for all parts. However, as the soil is very hygroscopic the fall was not sufficient to drain the land properly and it was found that the water level at the mouth of the canal must be further lowered. To this end a study of the situation was made with a view to the installation of a pumping plant.

The water encountered is from two sources, run-off from the tributary watershed, and back-water from the Tualatin River during its flood period. Across the lower end of the lake, between it and the Tualatin River, the county road is built on a dike, crossing

Fig 3. Bridge and County Road Dike at Lower End of Wapato Lake.

the stream from the lake at the bridge shown in Fig 3. To eliminate the back-water from the river it was necessary only to close this opening. As the soil at this point consisted of a thin layer of "beaver dam," overlaying a thick stratum of blue clay it was decided to install the pumping plant at this point, especially as piling could be driven to a satisfactory bearing. Fig. 4 shows the general plan of the plant and dams and sections of the dams.

Studies of the run-off, rainfall, and character of the watershed indicated that the pumping plant would have to handle 70 sec. ft. of water against a head of 8 ft. as a maximum condition, requiring about 125 h.p. This maximum demand would occur only three or four times a year and for periods of a few days or weeks at most, the pump being idle the rest of the time.

As the transmission line serving this part of the county operated by the Washington-Oregon Corporation was already heavily burdened with a rather low power-factor service this type of load was not looked upon with any great degree of enthusiasm by the power company, especially as they were already having some difficulty with voltage regulation, and were operating on power purchased at a rate determined by their highest peak demand. The superposing of this motor load on their present peak would cause a decided increase in their rate. The serving of this plant also entailed the outlay of considerable capital in transformers and line extension.

Careful studies were made of steam engine, Diesel engine, induction and synchronous motor drive for the pump and it is an interesting fact that even under these extreme conditions the first two methods were unable to compete with either form of electric drive. After many conferences with the officials of the power company the synchronous motor equipment herein described was adopted, as the best solution for both parties. The motor will operate continuously and be used, whether pumping or not, to correct the power factor of the power company's line.

A crescent shaped dam, Fig. 4, connects with the dike along which the county road runs, the machinery and gate houses being built on piling driven as an integral part of the dam, with the discharge pipe running through the dam and discharging into the bed of the natural stream.

The pump is a 30 in. vertical centrifugal designed and built by the Traylor Engineering Company, rated at 32,000 gal. per minute at 8 ft. head normal and 45,000 gal. per minute against the same head maximum. The guaranteed efficiency at normal discharge is 65 per cent. The pump operates submerged and is suspended from the framework by a steel lattice structure which is shown in Figs. 5 and 6. It is connected by a cut steel bevel gear and pinion to a horizontal shaft, driven through a Dodge-Orton friction clutch by a synchronous motor.

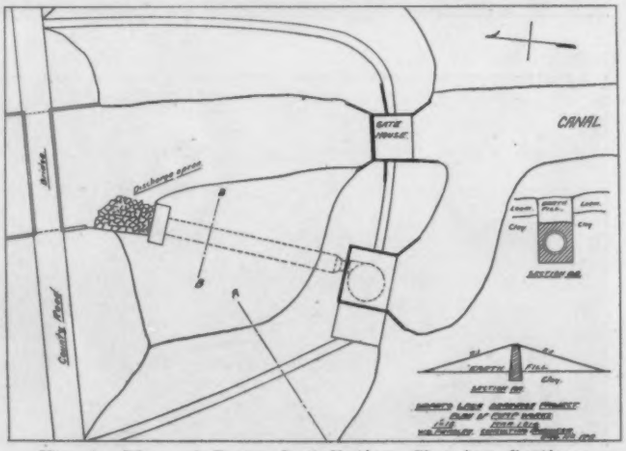


Fig. 4. Plan of Pump Installation, Showing Sections of Dam and Pipe Trench.

The motor is rated ATI-14 pole-180 k.v.a.-514 r.p.m.-2200 volt and is guaranteed to deliver 185 h.p. at 85 per cent power factor under standard conditions of overload and temperature rise. The motor is arranged for self starting and synchronizing and the amortisseur windings serve also to reduce any tendency to hunting that might arise from perodic fluctuations of the line conditions. Starting is accomplished by means of a standard three-phase compensator, equipped with overload and low voltage protection,

the overload relays of the automatic line switch giving protection during starting while those of the compensator are also in the circuit during running.

The exciter is belt driven from the motor shaft and is of the latest interpole design. All the electrical equipment was furnished by the General Electric Company.

The entire machinery is mounted on a frame work of 12x16 and 12x12 timbers supported on piling driven in the clay until no further penetration was secured. The equipment is protected by a house of galvanized corrugated iron and four windows are provided to insure ample illumination.

The discharge pipe made of wood stave is 44 in. in diameter with steel rod bands spaced 10 in. and

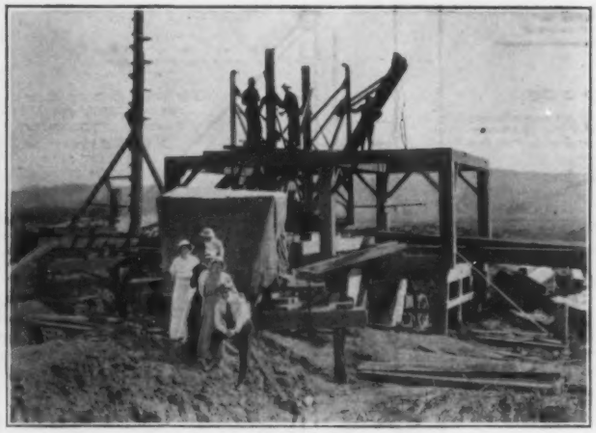


Fig. 5. Pump Assembled and Ready to Lower Into Place, Showing Lattice Supporting Structure.

is connected to the pump by a steel expansion joint. It is laid in a trench cut through the dam below the natural ground surface and then thoroughly puddled in place with clay to prevent any leakage through the dam at this point. A discharge apron of heavy boulders is provided at the discharge end of the pipe to break up the stream and reduce erosion.

The dam is an earth fill with a central clay puddle carried below the natural clay sub-strata. Sheet piling is driven around the gate house and pump pit, forming wings at the ends of the dam as shown by the heavy lines of Fig. 4.

The switchboard equipment includes an automatic line switch, field switch, line and field ammeters, and rheostat mechanisms for motor and exciter field rheostats.

The lighting circuit is supplied from a separate transformer connected outside the line switch so that lights are always available even though the line switch is open.

At present writing no tests have been made on this installation as the low water period is now on, but it is planned to make complete tests during high water to determine the efficiency of the plant.

Under present conditions the lake will be allowed to flood during the winter and the pump started about April 1 and kept running when necessary to keep the water at a safe level until the crop is harvested, when it will be again allowed to flood. Ultimate plans include a dike around the entire project and then the soil will be available at its full value.

Following are extracts from the power contract that are due to the particular type of apparatus installed:

The Power Company shall make every practical endeavor to maintain normal voltage and frequency and the Garden Company will undertake on its part that, so far as the nature of its work will permit, it will so regulate its use of electrical energy that the load will not vary suddenly more than twenty per cent (20 %) not including starting or stopping conditions and shall maintain equality of load upon the phases within ten per cent (10%) of the load of the loaded phase.

The Garden Company agrees that at its own expense it will install a synchronous motor of at least one hundred eighty (180) horsepower capacity at eighty-five per cent (85%) power factor with suitable starting compensators and that at its own expense, it will operate the said motor in connec-

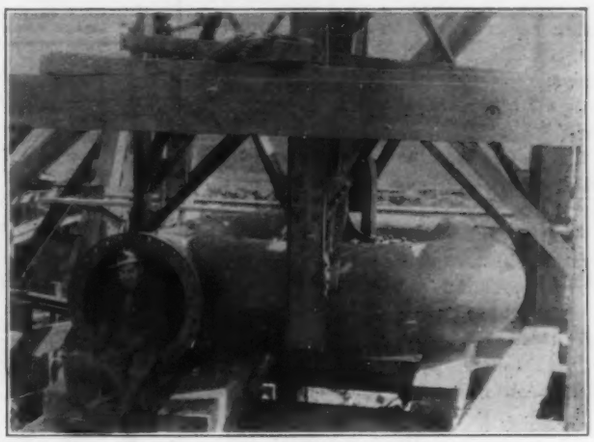


Fig. 6. Method of Attaching Steel Structure to Pump.

tion with its pump for at least seven months during the term of this contract. During the remaining five months the Garden Company shall have the right to suspend pumping operations but it shall at its own expense and at all times if the Power Company so desires continue to operate the motor independent of the pump and without load during the suspension period of pumping operations. In the event of such suspension of pumping operations the Power Company shall pay for any power by it consumed during the period of such suspension, and the Garden Company shall pay all other operating expenses.

The Power Company shall have the right and authority at all times during the term of this contract to regulate the field excitation of the said synchronous motor for the purpose of correcting the power factor on its system. The Power Company shall also have the right if it so elects to install a regulator or some other device for the purpose of automatically correcting the power factor on its system.

It is understood that for the purpose of determining the maximum peak for three consecutive minutes there shall be installed and maintained without cost to the Garden Company, graphic indicating wattmeters in the Power Company's substation at Beaverton and in the pump house of the Garden Company at Gaston.

Extract from letter from the Washington Oregon Corporation regarding power contract with the Gaston Gardens Company:

In the matter of responsibility for the operation of the motor during the five months period of suspension of pumping operations provided for in the agreement submitted by us we will agree and do hereby agree to assume this responsibility during such portion of the five months during which the motor is used solely by us for power factor correction purposes.

ELECTRIC DISTRIBUTION

STANDARDS AT SAN DIEGO.

BY L. M. KLAUBER.

D. Overhead Construction.

[Continued.]

(The fifth in the series of Mr. Klauber's articles is concerned with guys, guy wires and dead ends.—The Editor.)

The instructions contained in the handbook are as follows:

Guys and Guy Wire. D, 50, 1, 2, 3.

Size of guy wire—Use ¼ in. guy wire only in the following cases:

1. Head guys holding an unbalanced strain no greater than 3 No. 6 wires.

2. Arm guys holding an unbalanced strain no greater than 3 No. 4 wires.

3. Span guys for incandescent lamps.

In all other cases use 5/16 in. guy wire.

Size of guy clamps—Use 2 bolt clamps on ¼ in. guy wire and 3 bolt clamps on 5/16 in. guy wire.

Strain insulators—Use 3¼ in. glass strain insulators in ¼ in. guys, 3½ in. brown porcelain strain insulators in 5/16 in. guys, and 5½ in. brown porcelain strain insulators in all guy wires attached to any pole carrying 11,000 volt line.

In guys running to grounded anchors place one strain insulator not less than 4 ft. nor more than 8 ft. from the pole, measured along the guy. See Sheet D. 50.6.

In span guys place two strain insulators each not less than 4 ft. nor more than 8 ft. from the near pole.

Thimbles—Use ⅜ in. thimbles on all guys at point of attachment to anchors. For two guys to the same anchor use two thimbles.

Pole collars—Use pole collars on all guys attached to wooden poles or stubs.

Lag screws—Use 2 ½x3½ in. galv. lag screws as shown in Sheet D 50.4 whenever the slope of the guy is steeper than 1 foot in 10 feet.

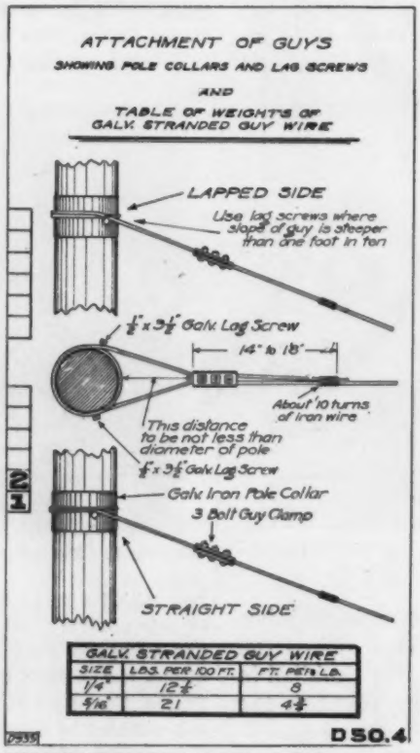
Cross arm guys—Use only when required by unbalanced strain. Use bridle guys only on light leads.

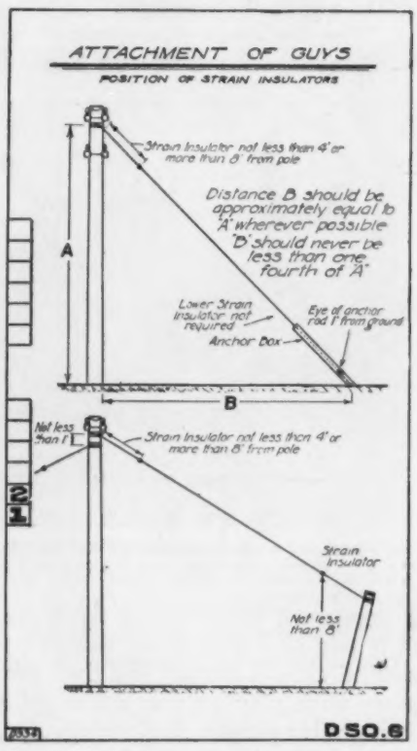
Two or more guys to same pole—When two guys hold a heavy lead to the same anchor place the first guy directly below the top arm and the second directly below the third arm.

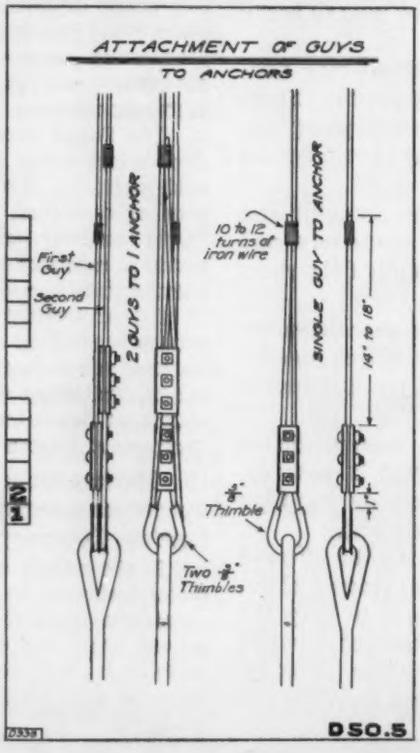
Where two or more guys are attached to any pole carrying electric wires there must be at least one foot between any two guys at the point of attachment to the pole, regardless of whether the guys pull in the same direction or not. This does not apply to arc span poles, stubs or other poles carrying no electric wires; in such cases the guys may all be attached at the same point. (State law.)

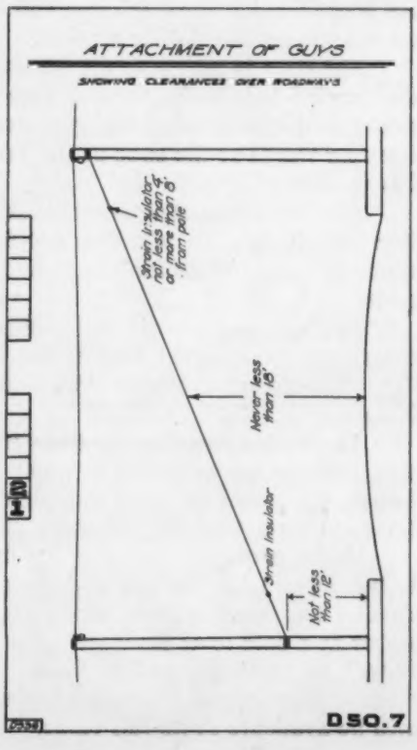
Clearances above streets and sidewalks, of guys to stubs or poles must be as shown in Sheets D 50.7 and D 50.8.

Location of anchors—Wherever possible anchors should be located so that distance to foot of pole equals the height of the point of attachment above the ground. In no case should the distance from the pole be less


ATTACHMENT OF GUYS
SHOWING POLE COLLARS AND LAG SCREWS
AND
TABLE OF WEIGHTS OF
GALV. STRANDED GUY WIRE
LAPPED SIDE
Use lag screws where slope of guy is steeper than one foot in ten
½" x 3½" Galv. Lag Screw
14" to 18"
About 10 turns of iron wire
This distance to be not less than diameter of pole
½" x 3½" Galv. Lag Screw
Galv. Iron Pole Collar
3 Bolt Guy Clamp
STRAIGHT SIDE
GALV. STRANDED GUY WIRE
SIZE | LBS. PER 100 FT. | FT. PER LB.
¼" | 12½ | 8
5/16" | 21 | 4⅘
D50.4


ATTACHMENT OF GUYS
POSITION OF STRAIN INSULATORS
Strain Insulator not less than 4' or more than 8' from pole
Distance B should be approximately equal to A wherever possible
B should never be less than one fourth of A
A
Lower Strain Insulator not required
Eye of anchor rod 1' from ground
Anchor Box
B
Not less than 1'
Strain Insulator not less than 4' or more than 8' from pole
Strain Insulator
Not less than 8'
D50.6

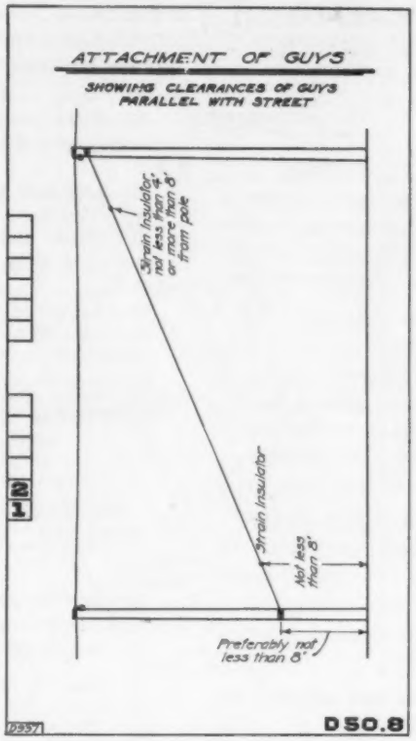


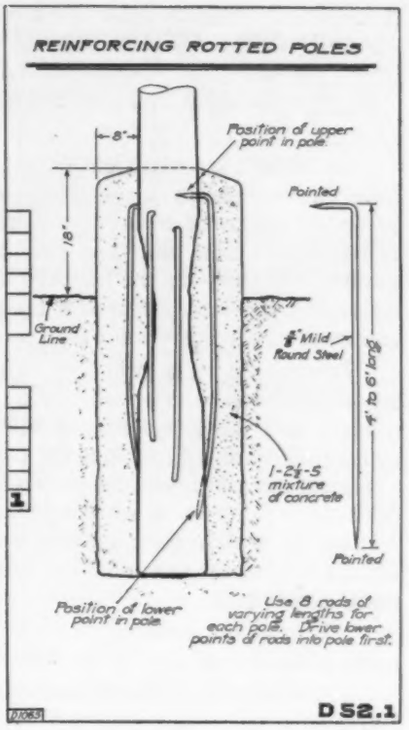

ATTACHMENT OF GUYS
SHOWING CLEARANCES OVER ROADWAYS
Strain Insulator not less than 4' or more than 8' from pole
Never less than 15'
Strain Insulator
Not less than 12'
D50.7

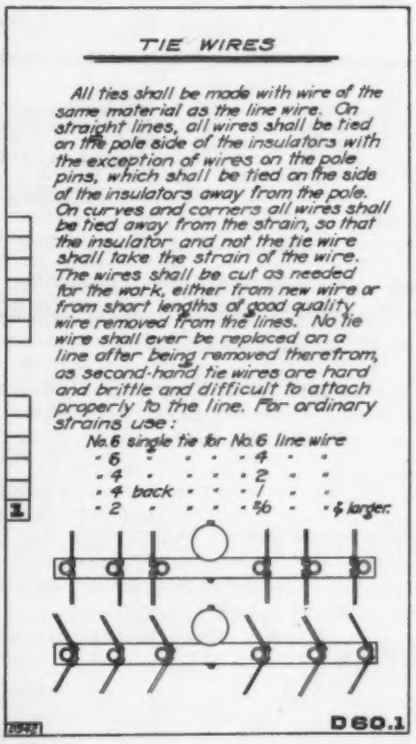
than one-fourth the height of the point of attachment above the ground.

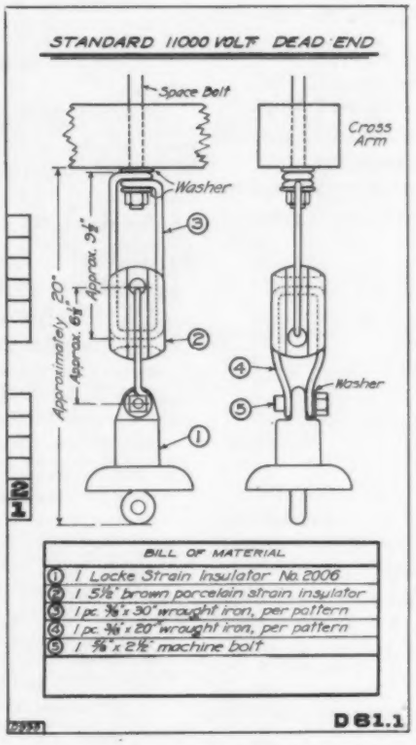
Size of anchor rods—Use ⅝ in. galvanized rod with 2 in. square nut ¾ in. thick for all regular anchors.

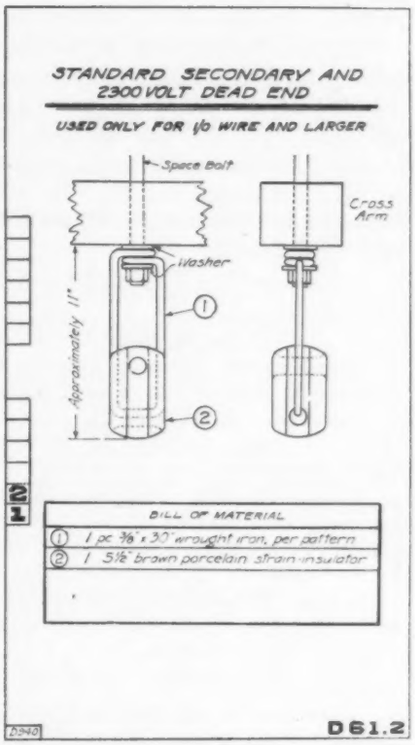
Use ¾ in. galvanized rod with 2 in. square nut ⅞ in. thick for all anchors where 2 or more guys are brought to the same anchor.


ATTACHMENT OF GUYS
SHOWING CLEARANCES OF GUYS PARALLEL WITH STREET
Strain Insulator not less than 4' or more than 8' from pole
Strain Insulator
Not less than 8'
Preferably not less than 8'
D50.8




TIE WIRES
All ties shall be made with wire of the same material as the line wire. On straight lines, all wires shall be tied on the pole side of the insulators with the exception of wires on the pole pins, which shall be tied on the side of the insulators away from the pole. On curves and corners all wires shall be tied away from the strain, so that the insulator and not the tie wire shall take the strain of the wire. The wires shall be cut as needed for the work, either from new wire or from short lengths of good quality wire removed from the lines. No tie wire shall ever be replaced on a line after being removed therefrom, as second-hand tie wires are hard and brittle and difficult to attach properly to the line. For ordinary strains use:
No. 6 single tie for No. 6 line wire
" 6 " " " 4 " "
" 4 " " " 2 " "
" 4 back " " " 1 " "
" 2 " " " 1/0 " " & larger.
D60.1


STANDARD 11000 VOLT DEAD END
Space Bolt
Cross Arm
Washer
Approx. 3½"
Approximately 20"
Approx. 6½"
Washer
BILL OF MATERIAL
① 1 Locke Strain Insulator No. 2006
② 1 5½" brown porcelain strain insulator
③ 1 pc. ⅜" x 30" wrought iron, per pattern
④ 1 pc. ⅜" x 20" wrought iron, per pattern
⑤ 1 ⅝" x 2½" machine bolt
D61.1


STANDARD SECONDARY AND 2300 VOLT DEAD END
USED ONLY FOR 1/0 WIRE AND LARGER
Space Bolt
Cross Arm
Washer
Approximately 11"
BILL OF MATERIAL
① 1 pc. ⅜" x 30" wrought iron, per pattern
② 1 5½" brown porcelain strain insulator
D61.2

D 60: Ties and Dead Ends. The matter on ties (D 60.1) is abridged from the N. E. L. A. Specifications. Specifications for dead ending lines contained in the book are as follows:

Dead end primaries, arcs or secondaries of No. 4 wire or smaller on break arms or 3½ in. brown porcelain strain insulators using wire loops. No. 4 or No. 6 wires can also be dead ended on locust pins and D. G. D. P. insulators (double armed) provided it is apparent that the same line will be extended later without a break. In all cases where secondaries or primaries are broken at a double arm, use 3½ in. porcelain strain insulators and wire loops. Do not break between two pins of a double arm.

Dead end primaries, arcs or secondaries, No. 2 or larger, using 5½ in. porcelain strain insulator and iron loops as per Sheet D 61.2.

Dead end 11,000 volt lines as shown on Sheet D 61.1.

All wrought iron loops to be painted with one coat of Glidden's acid-proof coating and one coat of Dixon's black graphite.

[To be continued.]

A KEY TO THE INDEX OF ELECTRICAL DEFICIENCIES, AS URGED BY THE UNDERWRITERS' EQUITABLE RATING BUREAU, PORTLAND, ORE.

BY F. D. WEBER.

In order that electrical contractors, or other persons interested, may be able to properly correct defective electrical installations, the writer has taken a list of common electrical deficiencies found in the State of Oregon—and he believes same applies to other states as well—and prepared a key pointing out at least one method of correction.

In this way the writer is attempting to perform an educational work—which is many times badly needed, and thereby conserve the money of property owners who are willing to make correction of defective electrical installations. In some cases this should also raise the efficiency of the parties upon whom the correction of a defective installation may devolve. It should furthermore incidentally reduce the cost of electrical inspection.

The method pursued in making electrical inspections with this system is as follows:

(1) Inspector makes investigation and reports to Bureau.

(2) Form letter sent out to owners of defective installations, enumerating defects by numbers.

(3) Enclosed with form letter is a printed list setting forth the Index of Deficiencies.

(4) If, deficiency is new and does not appear on printed list the back of form letter is utilized and a new deficiency made and assigned a number.

(5) Certificate of correction at bottom of form letter to be returned to Bureau after proper correction of deficiency.

Criticism, discussion and additions to this key are invited.

Key to Index of Deficiencies.

Based on the following publications and reference will be made to same by use of underscored word.

Addenda: Addenda to the 1913 Edition of the National Electrical Code, published by the Underwriters' Equitable Rating Bureau.

Special Hazards: Recommendations for electrical installations in woodworking plants, manufacturing plants, mining plants, packing houses, warehouses, canneries, etc., published by the Underwriters' Equitable Rating Bureau.

Moving Picture Book: Specifications for the installation of moving picture machines. Published by Underwriters Equitable Rating Bureau.

Code—National Electrical Electrical Code.

Fittings—List of Electrical Fittings, published by the National Board of Fire Underwriters.

Motor Book: Wiring Data for for Direct and Alternating Current Motors. Published by Underwriters' Equitable Rating Bureau.

Note:—This key gives method of making correction of defects enumerated but does not attempt to cover every approved method of correction.

Variations of methods employed should be taken up with the Bureau or Inspection Department having jurisdiction.

Index to Deficiencies.

Adjusters:

1.—Unapproved cord adjusters.

See List of "Lamp Adjusters" in "Fittings"; also "Code" Rule 32, on Flexible Cord.

Attics:

10—Attics not properly bored and bushed.

See Code Rule 26 (f) Wires; also see "Addenda" p. 4. "All attics must be bored and bushed. Knobbing under roof joist and over floor joist will not be approved."

11—Attic inaccessible.

Inspector not able to gain access into same.

Boxes:

20—Lids not placed on outlet boxes.

See Code Rule 59 (h).

21—Outlet boxes loose.

See Code Rule 59 (f), also Fittings "Conduit Boxes."

Conduit:

30—Approved rigid or flexible conduit not used.

See Code Rule 58, also Fittings under heading "Conduit."

31—Conduit not locked to cabinet (a) or fittings.

See Code Rule 27 (a), also Code Rule 28 (b), and Fittings, Conduit outlet bushings, etc.

32—Conduit not properly grounded.

See Code Rule 27 (c), also Code Rule 28 (f), and Fittings "Ground clamps."

33—Condulets not installed on conduit.

Condulets and outlet boxes complying with the following:

Condulets and outlet boxes complying with the following: See Code Rule 27 (b), Code Rule 28(d)and Code Rule 59(c); Fittings "conduit boxes" and conduit outlet plates will be accepted.

34—Service conduit must extend to main line cutout or into cabinet if same is required.

See Code Rule 27 (a), Code Rule 28 (b), and Code Rule 12 (f).

35—Conduit installed without approved fittings.

See Code Rule 27 (b) (e), Code Rule 28 (d), and Code Rule 12 (f); Fittings "conduit boxes," "Conduit Outlet Bushings, Couplings and Fittings," "Conduit Outlet Plates."

36—Conduit (a) metal moulding system not continuous.

See Code Rule 27 (a), and Code Rule 28 (b). 36 (a) See Code Rule 29 (a).

37—Wires in conduit must have a double braided insulation.

See Code Rule 56; 22—Outlet boxes, (a) junction boxes, (b) condulets concealed, considered same as junction boxes; (a) See Fittings, p. 16, under heading, "Conduit Boxes"; (a) See Code Rule 27 (f) and 28 (g); (b) See "Fittings' under heading "For Use Only Entirely Exposed," p. 20.

Cords:

50—Cord not standard.

See Code Rule 54, and Fittings, "Rubber Covered Wire," division on "Flexible Cord."

51—Cords too long (a) or used other than as pendants.

See Code Rule 32 (d), Fittings; "Rubber Covered Wire," division on "Flexible Cord"; "Lamp Guards," "Lamp Adjusters."

52—Cords in show windows are prohibited.

See Code Rule 32 (e).

53—Lamp cords in bad shape (a) or hung on metal hooks, nails or grounded materials, (b) or run through partitions.

53. Worn out, (a) (b). See Code Rule 32 (d). Cords must not be run as circuits or through partitions. The system and material to use are set forth in Rule 16 Code.

54—Pendant cords ornamented with tissue paper or gauze.

If cords are ornamented with highly inflammable material as tissue paper or gauze, the fire hazard is increased, as this material is subjected to a steady heat if not to direct contact. Therefore, this Bureau does not sanction this practice.

55—Portable lamps, (a) motors, (b) fans, or (c) fixtures not connected through reinforced cord.

See Code Rule 32 (d), Fittings, "Wire rubber covered," Division on "Flexible Cord."

56—More than one cord in a rosette.

It is impossible for more than one "pendant cord" to hang as such from a rosette without being in contact with the other cords suspended from the same fitting. Consequently, this Bureau only sanctions the use of one cord in a rosette.

57—Pendant cords without knots in fittings.

See Code 32 (g).

58—Pendant cord attached to circuits without approved fittings.

All cords must be attached to circuit wires by approved fittings such as rosettes, bushed outlet boxes or condulets. See Code Rule 27 (b), 28 (d) and 71. See Fittings under heading "Rosettes Conduit Boxes.

59—Unapproved cord adjusters.

See approved List in Fittings under subject "Lamp Adjusters."

60—Cord circuits.

See Code Rule 32 (d). Cord (Pendant or Portable) must never be run as a circuit. A standard system of wiring must be used.

61—For pendant cords in wet or dusty places, use stranded brewery cord or packing house cord soldered direct to circuits, but supported independently; also weather sockets must be used.

See Code Rule 31 (b).

62—Two or more lights on one cord with one approved fitting.

Pendant drop lights must be installed with an approved fitting for attachment to the circuit and an approved socket for the attachment of each lamp. See deficiency (61) for exception.

63—Cord used for outside wiring not approved.

See Code Rule 32 (d). A Standard System of wiring must be used.

Cleats:

100—Three-wire cleats are prohibited.

See Code Rule 26 (h) and 62.

101—Wood cleats, staples or nails as insulators prohibited.

See Code Rule 16 (b), 62, 64, 26 (h), 26 (r).

102—Cleats should not be concealed.

See Code Rule 26 (r), unless single wire cleats are used, and it is impossible to comply with the above rule as regards separation of wires and distance from surface wired over.

103—Cleats used on outside of building.

See Code Rule 12 (d).

Cabinets:

110—Cabinets not properly made (a) or lined.

See Code Rule 70; See Deficiency 118.

111—No doors on cabinets.

See Code Rule 70 (g).

112—Cabinet doors not lined.

See Code Rule 60 (c) (d).

113—Wooden cabinets used with iron conduit.

See Code Rule 70 (b); See Deficiency 118.

114—Cabinet inaccessible.

See Code Rule 23 (c). Also as switches must be readily accessible, therefore the cabinets which they are placed in must also be readily accessible. See Code Rule 24 (a) (b).

115—Cabinet not dry inside.

See Code Rule 19 (c).

116—Cabinet not approved by N. E. C.

For construction of cabinets see Code Rule 70. See deficiency, 118.

117—Cabinets of approved type must be installed to enclose service switch and cutouts (a) lighting cutouts, (b) power cutouts, (c) fuses protecting motors, (e) rheostats.

See Code Rule 70 for construction of approved cabinets. In special hazards see "Special Hazards" Div. 18 for construction. When installed outside in the weather or exposed to dampness, see Code Rule 19 (c), also see Deficiency 118.

117.1—Cabinet too small for proper spacing of fittings inside.

See Code Rule 67-69-70.

Cabinets, Steel or Iron:

118—This Bureau will not sanction the installation of any steel or iron cabinets, except those bearing the Underwriters' label or those approved by them. (See last edition. List of Approved Electrical Fittings.)

Any person desiring to start the business of manufacturing cabinets can get full instruction regarding the label service by applying to the Underwriters' Equitable Rating Bureau.

Circuits:

120—Circuits overloaded.

See Code Rule 23 (d).

121—Circuits overfused.

See Code Rule 23 (e).

122—Circuits with more than 16 outlets approved only on written promise that current shall not exceed 660 watts.

See Code Rule 23 (d).

123—Insulation resistance of wires and fittings not sufficient—meter reading obtained when the circuit is apparently open.

See Code Rule 88.

Fittings:

130—Broken fittings.

All electrical fittings in old installations must be maintained in good condition, and no broken fittings installed in new installations.

131—Fittings loose from support.

All electrical fittings which are provided with screw holes, bolt holes or threads, must be installed in such a manner as to be secured firmly in place by making use of screws, bolts, lock nuts and bushings or screwing directly on to some rigid support. In general all fittings must be held rigidly and securely in position independently of the circuit wires to which they are attached. It may be necessary in many cases to furnish extra backing or supports to comply with this requirement. Also many times fittings become loose in existing installation and must be again secured in position.

132—Unapproved fittings (as snap switch.)

See Fittings for all approved electrical fittings. If a fitting is of very recent manufacture it might not appear in the list, and specific fittings which do not appear in the list should be taken up with the Bureau, to determine whether same is standard or not.

133—Improper use was made of approved forms of fittings.

Sometimes fittings which are approved for one class of work are used in connection with installations where the use of this approved fitting will make a hazardous condition. Therefore, approved fittings must be used in locations and in connection with wiring systems for which they are designed.

134—No support provided for fittings.

Electrical fittings, in general, must not be supported on circuit wires. They are generally furnished with provisions for support by screws, bolts, or screwing or backing to conduit.

135—Unapproved fittings.

See Fitting Book; See Code Rules; Class D 49 to 83.

Fuses:

140—Unapproved (a) or improper use of open link fuse blocks.

See Fittings under heading "Fuses, Open Link"; See Code Rule 23 (c) (d); See Code Rule 67.

141—Too many lights dependent on final fuse block.

See Code Rule for installation of .1 (d), 2 (e), 19, 23, 38 (d) and (e), 39 (h), 85 (m). Required capacity of .8 (b), 23 (d) and (e).

142—Cartridge fuse block bridged with string fuse or wire.

Only cartridge fuses must be used in cartridge fuse blocks. Substitutes are prohibited.

143—Improper fuse block (a) or none at entrance.

See "Fittings" under headings, Fuses, Enclosed Fuses, Open Link; See Code Rule 67. 143—(a) See Code Rule 19 (a); See Code Rule 23; See Code Rule 85 (m).

144—Arc lamps not fused individually.

See Code Rule 33.

145—Fuse block located over or near inflammable material.

See Code Rule 19 (b); See Code Rule 23 (c.)

146—125 volt fuses on 220 volt circuits.

See Code Rule 67; See Code Rule 68; See Fittings under heading "Cut-Out Bases." Fuses Enclosed" and "Fuses, Open Link."

147—Fuses too large to protect circuit.

See deficiency 141, also Cole Rule 18.

148—Refilled (a) or (reinforced) fuses.

The Underwriters' Lab. Inc have never approved any make of refillable use; 148 (a) Fuses must never be reinforced by any material whatsoever and as this destroys all their protective value after being reinforced may "blow" at almost any overload and in a large percentage of cases not at all.

149—Cutouts (a) fused switches of too large a rating to properly take fuses which will protect system.

Cutouts are constructed and designed to take fuses between certain standard ampere ratings and will not take any other capacities. Cutouts designed for 101-200 amp. capacity must not be used where 30 amps. only is required to properly protect the circuit. See Code Rule 67 and 68; 149 (a), See Def. 149 and Code Rule 65.

Flexible Tubing:

170—Flexible tubing too short at outlets.

See Code Rule 26 (u) (s); See Fittings under heading "Tubing-Flexible."

171—Flexible tubing used through floors or in damp places.

See Addenda Page 95; See Code Rule 16 (d); See Code Rule 26 (r).

172—Service wire bushed with flexible tubing; must be porcelain or conduit

See Code Rule 12 (f).

173—Where wires are not spaced 5 inches, every wire must be separately encased in continuous flexible tubing.

See Code Rule 26 (r); See Addenda, page 5.

174—Porcelain and flexible tubing out of place.

All porcelain or flexible tubing which is used in connection with a system must be retained in its proper position.

This can be done by the use of taps, knobs, cleats or other fittings.

Feeders:

200—Feeders overloaded.

Fixtures:

210—Electric fixtures not properly installed.

See Code Rule 24 (e); See Code Rule 26 (v) to (y); See addenda, pages 5 and 6.

211—Fixtures canopies on top of circuit wires or pendant switch wires.

Fixture canopies may be punched and bushed with approved bushings for the wires to pass through as flexible tubing or porcelain placed on wires for the canopies to rest on.

212—Not properly insulated.

See Code Rule 30 (a); See Fitting under heading "Insulating Joints and Canopy Insulators"; Addenda, page 6.

213—Chain fixtures in show windows are prohibited.

See Code Rule 30 (c).

214—Broken or (a) loose from support.

No broken fittings should ever be installed and when fittings in existing installations become broken they must be replaced. 214 (a) Fittings must be secured in position by screws and bolts.

Grounding Low Potential:

220—Low potential circuits not properly grounded on the direct current three-wire system, (a) alternating current secondary system.

See Code Rule 15.

221—Ground connections not made according to rules and requirements of N. E. C.

See Code Rules Ground Connection 15.

Ground Wires—

For armored cables	27 (c)
For interior conduits	28 (f)
For lightning arresters, 5 (c), 40 (j), 85 (l)	86 (a)
For metal moulding	29 (d)

Grounding—

Armored cable	27 (c)
Dynamo and generator frames	1 (c)
Interior conduits	28 (f)
Low potential circuits	15
Metal moulding	29 (d)
Motor frames	8 (a)
Sheaths of cables	12 (h)

See Fittings under heading "Ground Clamps."

Heating:

225—Electric iron improperly installed.

See Code Rule 25.

Hazardous:

230—Installation in such a hazardous condition that same should be completely re-wired.

Insulators:

240—Improper canopy insulator (a) or none preventing contact between canopy and steel ceiling, gas pipe or grounded surfaces.

See Code Rule 30 (a); See "Fittings" under heading "Insulating Joints" and "Canopy Insulators"; See Addenda, page 6.

241—Cross-over tubes or insulators not properly fastened in place.

See Deficiency 174; See 242.

242—Insulating joints must be used.

See Code Rule 30.

Joints:

260—Joints not soldered, (a) or taped, (b) or properly made.

See Code Rule 16 (c).

261—No rubber tape on joints.

See Code Rule 16 (c).

Lamps:

270—Lamps hanging against woodwork. When incandescent lamps are hung against woodwork the heat of the lamp will char the wood in a very short time and sometimes even cause same to immediately ignite. The ignition sometimes does not take place until a strong current of air happens to strike the charred place then it will burst into flames.

See Code Rule 32 (d); See Fittings "Lamp Guards."

271—Open arc lamp inside of building.

See Code Rule 21; See Code Rule 33.

272—Miniature light wiring not approved.

Miniature sockets are only approved inside of buildings. See Fittings under heading Sockets. Subdivision Candelabra and Miniature. All wiring to these sockets must be standard also.

273—Lamps must be equipped with approved lamp guards.

See Fittings under heading "Lamp Guards"; See Code Rule 32 (d).

274—Single or grouped display lamps on special electrical effects not properly installed. Many times merchants and business houses build up all manner of advertising "stunts" without any regard to Code requirements and which are extremely hazardous.

Loose:

290—Bad or loose connections at fuse blocks and switches. All connections to fuse blocks and switches must be made in a tight and secure manner.

291—Switches loose. Switches must be held in position by independent supports other than those of the circuit to which they are attached.

Lugs:

300—No terminal lugs used.

See Code Rule 16 (c).

Moulding:

310—Moulding not properly made (a) or painted, (b) or used in damp places.

For wooden mouldings see Code Rule 60 (a), (b), 310 (b) See Code Rule 26 (b); Metal moulding, See Fitttings "Moulding Metal."

311—Moulding without capping.

All moulding must be installed with capping. Wooden moulding, see Code Rule 60 (b).

312—Moulding run on grounded surfaces without backing. When wooden moulding is run on grounded surfaces, the same must be secured to a wooden backing and not directly to grounded surface.

313—Soft wood moulding used instead of hard wood moulding.

See Addenda, page 4; See Code Rule 60 (b).

314—Moulding installed without taplets.

See Code Rule 26 (k); See Fittings heading "Moulding Fittings."

315—Concealed moulding.

See Code Rule 26 (I).

Motors:

330—Motor overfused.

See Code Rule 8 (b) (c); See Code Rule 23 (e); See "Motor Book."

331—Motor should be enclosed.

See Code Rule 8 (b); See Code Rule 8 (f).

332—High potential motor frames not grounded (a) conduit, (b) sheath of the lead covered cable.

See Code Rule 8 (b).

333—High potential motor not installed according to National Electrical Code.

See Rule 8 (b); See Code Rules 44 to 46; See Code Rules 47 to 48.

334—Motor base frames not permanently grounded (a) not thoroughly insulated.

See Code Rule 8 (a); See 335.

335—Remote control of motor unapproved.

See Code Rule 8 (c).

Outlets:

340—Outlets not in use should be thoroughly taped up. At all outlets where ends of wire are exposed and are not attached to approved fittings, the same should be thoroughly taped up.

Outline Lighting:

345—Method of installing "outline lighting" not approved by National Electrical Code.

See Code Rule 39.

Protectors:

350—No protector (a) or improper protector at entrance on telephone or signal wires, (b) or protector improperly located.

See Code Rule 85 (g); See Code Rule 85 (j) (m); See Fitting under heading "Protectors."

Receptacles:

360—Lamp receptacles with exposed lugs or contacts in show window. Due to the fact that show windows contain a miscellaneous assortment of merchandise, lamp receptacles with exposed lugs or contacts must not be used.

361—No sub-base under snap switch (a) or receptacles.

See Code Rule 24 (f). When concealed type of receptacles are used with exposed knob and tube work, sub-bases must be used also; See Fittings under heading "Receptacles."

362—Unapproved receptacles.

See Fittings under heading "Receptacles."

Rosettes:

370—Unapproved rosettes.

See "Fittings" under heading "Rosettes."

Rheostats:

380—Rheostat not properly mounted.

See Code Rule (4). Nearly always rheostats are shipped for switchboard mounting and therefore have to be mounted before being installed. See 381.

381—Rheostat not properly enclosed by netting (a) in a dust-proof and fire-proof cabinet (b) by dust-proof face plates.

Rheostats built up by private parties, many times are of open coil construction. The same not being enclosed by a fine mesh netting. This being necessary in case the coils burn up and the netting will then prevent the fused portions of the coils from coming in contact with combustible materials.

381 (a) When rheostats are not provided with dust-proof face plates they must be enclosed in a dust-proof and fire-proof cabinets, if exposed to wetness, dusty or linty places.

381 (b) See Code Rule 4 (a).

See Code Rule 24 (a).

Signal Systems:

385—Signal system not installed according to the National Electrical Code.

See Code Rule 85.

Switches:

390—Improper switch (a) or none on fan or motor circuit.

See Code Rules where double poles are required 8 (c), 19a. Where indicating is required 8 (c); Must disconnect all the wires 19 (a), See Fittings under heading "sws."

391—Improper switch (a) or none at entrance point.

See Code Rule, must be indicating 65 (a) and (b), must disconnect all the wires of the circuit; 19 (a), Service switch; 20 (b), 24 (a), 65 (a); See Fittings under heading "sws."

392—Entrance switch improperly located (a) or not readily accessible.

See Code Rule 24 (a).

393—Entrance switch (a) or fuse on house side of meter.

394—Knife switch inverted (a) or located on line side of entrance fuse.

See Code Rule 24 (b); See Code Rule 24 (a) and 19 (a).

395—120-volt switch on 220-volt circuit.

See Code Rule 65 for proper spacing of parts.

396—No sub-base under snap switch (a) or receptacles.

See Code Rule 24 (f).

397—Switch and cutout must be placed in approved cabinet.

See Code Rule 70; See Addenda, page 8; Cut-out and switch. Use of—19 (b) to (d), 23 (c) and 24b; For rheostats and autostarters, when required 8 (d). Sometimes in the judgment of the inspector conditions are such that cabinets are required in locations and under conditions not covered in the N. E. C.

398—Main service switch and fuse too far from the entrance of service wires to building.

See Code Rule 24 (a). Service switch and cutout must be placed as near entrance of service wires to a building as is possible in order to get protection for the building. If this is not done, heavy short circuits, or grounds may burn the service wires up and cause fire and when this distance is of appreciable length the fire hazard from trouble is increased unnecessarily.

399—Motor switch and cut-out must be placed in cabinet.

See Def. 397; See Code Rule 19 (b).

401—Main or branch switches wired in "hot."

See Code Rule 24 (b); See Code Rule 69 (a). See Code Rule 19 (d).

Signs:

420—Electric signs not constructed and installed according to National Electrical Code.

See Code Rule 83; See Addenda, page 8.

421—Sign flashers must be installed in approved standard iron cabinet.

Sockets:

430—Lamp sockets not bushed.

See Code Rule 32 (f).

431—¼ in. sockets used on reinforced cord instead of ⅜ in. sockets.

The ¼ in. sockets are so small that the requirement of Rule 32 (f) requiring bushings in same cannot be complied with. Therefore the ⅜ in. socket must be used.

Switch Boards:

440—Not constructed of slate, marble or approved composition if constructed prior to 1913 skeleton form hardwood passable.

See Code Rule 3.

441—No approved ground detector.

See Code Rule 7.

Trolley Current:

450—Current for motor (a) or lights taken from trolley current.

See Code Rule 42. This applies to connections direct to trolley wires with grounded or insulated return when generator or converters are grounded. It also applies to systems which are attached to trolley system bus-bars, whether or not the distribution system is a two wire insulated circuit or ground return.

451—Current for motors (a) or lights taken from trolley bus.

See Deficiency 450.

Theatres and Moving Picture Establishments.

460—Theatre and moving picture establishments, (a) dressing rooms, (b) auditorium, (c) stage, (d) lobby, not installed in approved conduit.

See Moving Picture Book; See Code Rules; Dressing Rooms 38 (j), Auditorium 38 (t), Stage 38 (b), Lobby same as Auditorium; See Fitting Book; under heading Conduit.

462—Moving picture theatre not installed according to standard specifications.

See "Moving Picture Book"; See Code Rule 38 (u) and (v).

463—Service not according to rules and requirements of National Electrical Code.

See Code Rule 38.

464—Footlights (a) borders, (b) proscenium sidelights, (c) strips, (d) proscenium lights, (e) portable equipment, (g) switchboard, (h) stage pockets, not installed or constructed according to the National Electrical Code.

See Code Rules; Footlight 38 (d), Borders 38 (e), Border Cables 54 (i), Proscenium Sidelights 38 (e), Strips 38 (m), Proscenium Lights 38 (e), Portable Equipment 38)k), Portable Plugging Boxes 38 (n), Portable Conductors 383 (p), 54 (c), Switchboards 38 (c), Stage Pockets 38 (f); See Fittings "Theatre Appls."

465—Exit and emergency lights not fed from a point ahead of main service switch and cutout.

See Code Rule 38 (a).

466 (a) Supply must be of No. 8 because of the starting current of the arc lamps.

466 (b) See Fitting Book under heading "Receptacles" for attachment plugs; "Stage Receptacles."

466 (c) See Code Rule 54 (i); See Fittings "Flexible Cord."

Transformers:

480—Not of approved make.

See Fittings "Transformers"; subdivision Bell Ringing.

481—Sign transformer not properly mounted (a) or not of approved make.

See Code Rule 11, 14 (a) and (b), 36, 45; See Fittings "Transformers."

482—Transformer cases not thoroughly grounded.

See Code Rule 11.

[To be continued.]

EFFICIENT POWER PLANT MANAGEMENT

CORRESPONDENCE FILING CLASSIFICATION

[Concluded.]

720—Machinery and Tools.
- 721—Steam Boilers and Accessories.
  - 721.1—Boilers.
  - 721.2—Grates and Stokers—Stacks and Flues—Draft Equipment.
  - 721.4—Feed Water.
    - 721.42—Feed Water Heaters and Economizers.
    - 721.43—Hot Wells.
  - 721.5—Steam.
    - 721.51—Superheaters.
- 722—Prime Movers and Auxiliaries.
  - 722.1—Steam Engines and Steam Turbines.
    - 722.11—Steam Condensers.
    - 722.12—Cooling Towers and Sources of Cooling Water.
  - 722.2—Gas, Gasoline and Oil Engines.
  - 722.3—Water Wheels—Water Turbines.
    - 722.31—Governors for Water Wheels and Water Turbines.
- 723—Mechanical Transmissions.
  - 723.1—Shafts.
  - 723.2—Gears.
  - 723.3—Pulleys.
  - 723.4—Belts.
- 724—Lifting and Transporting Equipment.
  - 724.1—Cranes and Derricks.
  - 724.2—Power Shovels—Graders—Excavators.
  - 724.3—Elevators—Lifts—Hoists.
  - 724.4—Industrial Cars and Tracks.
  - 724.5—Wagons—Scrapers—Wheelbarrows—Horses
  - 724.9—Other Lifting and Transporting Equipment.
    - 724.91—Rope—Chain—Steel Hoisting Cable.
- 725—Concrete—Gravel—Rock and Sand Equipment.
  - 725.1—Crushers.
  - 725.2—Screens—Washers—Driers.
  - 725.3—Mixers.
- 727—Machine Tools and Shop Equipment.
  - 727.1—Lathes — Shapers—Drill Presses—Planes—Shears—Riveters.
  - 727.2—Forges—Anvils — Welding Outfits — Blacksmith Equipment.
- 728—Small Tools.
  - 728.1—Earth Working Tools.
    - 728.11—Picks and Shovels.
    - 728.12—Bars and Drills (Power Hand Drills)
  - 728.2—Line Construction Tools.
  - 728.3—Engineers' and Surveyors' Instruments.
  - 728.4—Laboratory Equipment.
  - 728.9—Miscellaneous Small Tools.
- 729—Other Machinery and Tools.
  - 729.1—Scales and Other Weighing Devices.

730—**Operating Supplies for Stations.**
- 731—Fuel and Oils.
  - 731.1—Coal (Gas and Steaming).
  - 731.2—Oils.

    (If Transformer Oil, file under 324.) (If Switch Oil, file under 322.) (If Lightning Arrester Oil, file under 334.)
    - 731.21—Fuel Oil — Distillates — Gasoline—Naptha—(Gas and Steaming.)
    - 731.22—Lubricating Oils.
    - 731.23—Illuminating Oils.
    - 731.29—Other Oils.
  - 731.3—Wood.

    (If for structural purposes, file under the 712 series.)
  - 731.4—Coke.
  - 731.9—Other Fuels.
- 739—Petty Station Supplies.
  - 739.1—Cotton Waste and Wiping Rags.

740—**Pumps—Pipe — Penstocks—Valves—Fittings—Hose—Accessories.**

(If part of electric customer's equipment, file under 366.1 series.)
- 741—Pumps—Air Compressors—Blowers.
- 742—Pipe—Penstocks.
  - 742.1—Leakage.
- 743—Valves and Hydrants—Service Cocks.
- 744—Fittings.
- 745—Hose.
- 749—Accessories.
  - 749.1—Pressure and Vacuum Gauges.
    - 749.2 — Lead — Oakum — Yarn—Gaskets — Packing.

(See 739.1 for Waste and Rags.)

750—Office—Camp—Commissary—Equipment—Furnishings — Supplies.
- 751—Office Equipment and Supplies.
  - 751.1—Furniture and Furnishings—Curtains—Awnings—Rugs—Safes.

    (For lighting fixtures, see the 361 or 461 series.)
  - 751.2—Mechanical Office Equipment—Typewriters—Adding Machines—Cash Registers—Cameras—Fire Extinguishers.
  - 751.3—Office Supplies.
    - 751.31—Printed Forms—Paper—Stationery.
    - 751.32—Catalogues—Price Lists—Discounts.

      (Note:—File under the specific equipment or thing involved, is possible.)
    - 751.39—Petty Office Supplies—Pencils—Ink Erasers—Rubber Stamps, Etc.
- 752—Camp and Commissary Equipment and Supplies.
  - 752.1—Tents.
  - 752.2—Kitchen and Dining Room Equipment—Stoves.
    - 752.21—Coke Heaters.
  - 752.3—Food Stuffs.
  - 752.4—Merchandise—Clothing—Tobacco, Etc.
  - 752.5—Bunkhouse Equipment—Cots—Mattresses—Bedding, Etc.

790—**Other Materials and Supplies.**
- 791—Powder and Dynamite.

Telephone service at Shanghai is provided by a local company, which utilizes 5000 telephones, and is at present building an additional exchange in the residential part of the city. The telephone instruments now used by the company were manufactured in Sweden, and are far from being as satisfactory as those in use in the United States. The Shanghai Mutual Telephone Company, (Ltd.) was organized in March, 1900,, and, during its 14 years of existence, has grown steadily. The nominal capitalization of the company is $600,500, divided into 20,000 shares of the par value of $31.125 each. There have been issued 14,540 shares at par value, making a total of $452,557.50 paid in. On this sum the company paid, at the end of the last fiscal year, a dividend of 8 per cent

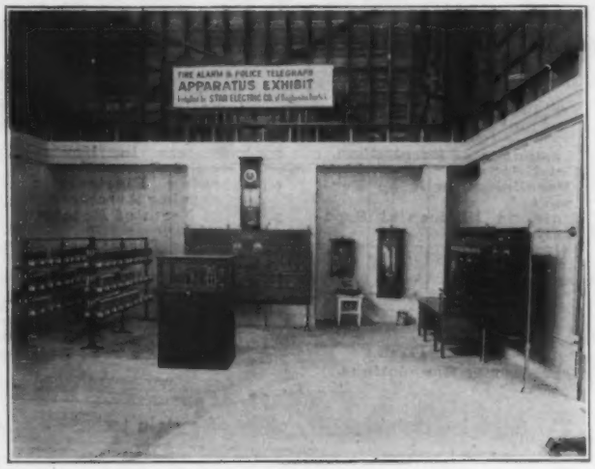
P. P. I. E. MACHINERY EXHIBITS

FIRST P. P. I. E. EXHIBIT.

The Department of Liberal Arts enjoys the distinction of having the first completed exhibit installed at the Panama-Pacific International Exposition. This is a "working exhibit" in the Palace of Liberal Arts by the Star Electric Company of Binghampton, New York, and forms the Central Fire and Police Alarm Signal Station for the entire exposition grounds.

While the Star Electric Company's exhibit is the first exhibit installed on the Exposition grounds it is the only one so far installed in the Palace of Liberal Arts, although there are enough other applications on file to more than fill this capacious building.

The Chief of Liberal Arts, Theodore Hardee, has been ready since last May to allot all the space at its disposal, but has been compelled to delay these allotments until the authorities at Washington decide whether the United States Government exhibit shall remain in the Palace of Liberal Arts or be housed in the special building recently provided by Congress. If the Government Exhibit Board relinquishes this large amount of space now assigned to it a complete reapportionment of the floor area must be made and the many applicants now on the reserve list will also be accommodated. It is expected that this matter will be determined at an early date and the allotment will then be made with all possible dispatch.



Central Office Equipment.

Engine House Equipment.

Installation was started by the Star Electric Company, on May 16th, of this year, the system being put into actual operation with 52 boxes in service on July 25, 1914.

The fire alarm system comprises a central office full automatic equipment, consisting of a twelve circuit switchboard, an eight circuit automatic repeater, with four local engine house circuits; signal wheel transmitter form transmitting still and special alarms; a punching register, take-up-reel and automatic time stamp for recording the exact time that an alarm comes in, the stamp being controlled by a self winding clock. Metal battery racks carrying storage batteries for operating both fire alarm and police telegraph systems. All testing of lines and batteries and battery charging is controlled from the main switchboard.

There are 102 fire alarm boxes of the latest approved type now installed throughout the grounds and buildings. These boxes are known as the type "C" or metropolitan boxes and are absolutely non-interfering and successive and so constructed that nine boxes may be pulled simultaneously and all of them will register in succession their respective signals.

Before the advent of this type of box, the greatest number of boxes which could be pulled simultaneously and insure a correct record was three. The insulation of the type "C" boxes is very high, as it has been proven by tests under actual working condition that 6500 volts will not injure them.

Each of the three engine houses in the grounds are equipped with an ornamental pressed steel panel, on which is mounted a twelve inch electro-mechanical gong, punch register, tapper bell, take-up reel and an automatic light switch, which turns on the lights in the engine house on the first stroke of the alarm, these lights being automatically turned off by the switch at a predetermined time, after the fire apparatus has left the house.

There is also a similar set of apparatus in the headquarters of the exposition military guards, in the Service Building.

There will be 102 seven call combination police telephone and signal boxes. These together with the fire alarm boxes are mounted on ornamental iron pedestals, surmounted by a red globe on which is etched "Fire Alarm" in white letters. A 25 watt Mazda lamp is used to illuminate the globe at night, to indicate the location of fire alarm and police boxes, and by means of a signal wheel transmitter, operated by an electric motor in the central office, code signals will be flashed on these lamps, to notify the guards that their services are required.

The central office police telephone and signal system, is in the same booth with the fire alarm system. A six circuit storage battery and central board provides facilities for charging storage battery and making tests and connections. In addition to this, there is a four circuit police desk, through which reports from guards and telephone calls are received.

REPORT ON INDUCTIVE INTERFERENCE.

(A report of the results and recommendations to the Railroad Commission of California by a joint committee authorized by the Commission to investigate remedies for the inductive interference of power lines with telephone communication. The findings were presented as a paper at the Spokane A. I. E. E. meeting on September 11, and the recommendations form the basis of an order from the Commission.—The Editor.)

The following paragraphs summarize very briefly the principal results accomplished to date. These statements of results are accompanied by brief explanatory comment upon the conclusions reached. The reasons for and explanations of these conclusions are given in more detail in the appendices to which reference is made.

1. *Interference to telephone circuits under normal operating conditions of power circuits arises almost wholly from the harmonic voltages and currents of the power systems. (See Appendix I).*

This is due chiefly to the fact that the frequencies of the harmonics generally present in the voltages and currents of power systems cover a considerable portion of the range of the voice frequencies particularly those frequencies at which telephone instruments and the human ear are of maximum sensibility. Extraneous currents of frequencies approaching the average voice frequency have a more injurious effect upon telephone conversation than currents of lower frequencies.

2. *The effect of induction of the fundamental frequency on telephone circuits is comparatively unimportant unless it is of magnitude sufficient to constitute a physical hazard. (See Appendix I).*

This is due to the fact that the fundamental approaches the lower limit of audible frequencies, at which the telephone and the human ear are not efficiently responsive.

3. *Interference to telegraph and other signaling circuits is due principally to the fundamental and lower harmonics. (See Appendix I).*

Telegraph receiving instruments are relatively insensitive, as compared with the telephone, to the higher harmonics, but are sensitive to disturbances of lower frequencies, such as the fundamental and lower harmonics which more nearly approach the normal operating frequency of such circuits.

4. *The power circuit currents and voltages may be divided into two factors: balanced and residual, of which, for equal magnitudes, the latter in general produce the greater inductive interference. (See Appendix II).*

Residual currents and voltages act inductively in a similar manner to single-phase currents and voltages acting in a circuit composed of the line conductors in parallel with earth return, which is a condition favorable to very large induction. Moreover, such a circuit which includes the earth as one side cannot be transposed. Transpositions in the power circuit cannot reduce the inductive effect of residuals except as they reduce the magnitudes of the residuals themselves, which they do in some cases. The inductive interference, arising from such currents and voltages can be reduced only in the case of metallic circuits such as telephone circuits, by transposing these circuits. It is therefore important that the telephone circuits be transposed at frequent intervals throughout parallels and carefully balanced throughout their entire length and that the residual currents and voltages be kept sufficiently small to give negligible induction in telephone circuits so arranged.

5. *Inductive interference to communication circuits, arising from the balanced voltages and currents, can in a large measure be prevented by means of an adequate system of transpositions applied to both power and communication circuits (assuming the latter are metallic) and located with due regard to each other.*

This is accomplished partly by creating mutually neutralizing inductive effects in neighboring lengths of each side of the communication circuit or circuits by transposing the power circuit, and partly by equalizing the inductive effects on the two sides of the communication circuit or circuits by exposing each side equally to the influence of the power circuit by transposing the communication circuit.

6. *Abnormal conditions and at times switching operations produce transient disturbances of a very severe character.*

This is due to the fact that abnormal conditions almost invariably give rise to residuals of large magnitude, often including high harmonics. Abnormal occurrences incident to electrical power transmission do not give warning of their occurrence, and since they cannot be produced artificially on transmission systems without subjecting the apparatus to great risk or danger, is has been deemed unwise to attempt any experimental tests of these effects. The conclusion is therefore drawn from general experience and data of actual occurrences collected by the committee.

Rules Recommended by the Committee.

The following are the rules which the committee, as the result of its study to date, recommends be issued at this time to govern the future construction and operation of power and communication circuits which are or are proposed to be so located as to create a parallel as hereinafter defined.

Outline of Rules.

Definitions.
a. Power Circuit.
b. Communication Circuit.
c. Telephone Circuit.
d. Line.
e. Parallel or Parallelism.
f. Residual Current.
g. Residual Voltage.
h. Transposition.
I. Avoidance of Parallelism.
II. Conditions under which Parallelism will be Permitted.
a. Minimum Horizontal Separation.
b. Balance of Power System.
c. Limitation of Residual Currents and Voltages.
d. Transposition Inside Limits of Parallel.
e. Transpositions Outside Limits of Parallel.
f. Uniformity of Parallel.
g. Transformer Connections.
h. Switch Equipment.
i. Switching.
j. Use of Air Switches.
k. Abnormal Conditions.
l. Devices for Indicating Abnormal Conditions on Systems Isolated from Ground.
m. Procedure under Abnormal Conditions.
n. Ammeters in Neutral Ground Connections.
o. Charging Electrolytic Lightning Arresters.
p. Wave Form of Rotating Machines.
q. Exciting Current of Transformers.
III. Provisions Applying to Existing Parallels.
IV. Waiver of Conditions by Communication Company
V. Parallelism with Alternating Current Railways

Definitions.

The following definitions are given of certain technical terms employed herein:

a. *Power Circuit.* The term "power circuit" includes any overhead constant potential alternating current power transmission or distribution circuit or electrically connected network which has a voltage of five thousand volts or more between any two conductors or of three thousand volts or more between any conductor and ground.

b. *Communication Circuit.* The term "communication circuit" includes any overhead, open wire telephone, telegraph, or signaling circuit which is used in the service of the public.

c. *Telephone Circuit.* The term "telephone circuit" includes any inter-exchange metallic telephone circuit, and therefore excludes subscriber's circuits. This term also includes any metallic telephone circuit operated by any railroad or other company for dispatching purposes or for public use between separate communities.

d. *Line.* The term "line" means any circuit or aggregation of circuits carried on poles or towers.

e. *Parallel or Parallelism.* The terms "parallel" or "parallelism" refer to cases where a power line and a communication line follow substantially the same course, or are otherwise in proximity for a sufficient distance, so that the power circuit is liable to create inductive interference in the communication circuits.

f. *Residual Current.* The term "residual current" denotes the vector sum of the currents in the several conductors of a power circuit.

g. *Residual Voltage.* The term "residual voltage" denotes the vector sum of the voltages to ground of the several conductors of a power circuit.

h. *Transposition.* The term "transposition" denotes the interchange of position of the several conductors of a circuit.

I. Avoidance of Parallelism.

Every reasonable effort shall be made to avoid new parallelism. The party proposing to build a new communication or power line, which will create a parallel, or generally to reconstruct an existing line involved in a parallel shall give due notice (at least thirty days wherever possible) of its intention to the other party, including detailed information as to the location and character of the proposed line. If a plan can be devised and agreed upon by the two parties for maintaining an adequate separation between the two classes of lines so as to avoid interference, this shall be done. In case it is impracticable to secure adequate separation between a power line and a communication line, parallelism will be permitted subject to the conditions set forth in II.

II. Conditions Under Which Parallelism Will Be Permitted.

a. *Minimum Horizontal Separation.* The minimum horizontal separation between the power line and communication line shall be equal to the height of the taller line. The only exceptions to this provision are angle crossings and other unavoidable cases of close proximity, and in all such cases the power line shall be kept above the communication line and constructed in conformity with the National Electric Light Association's specifications for overhead crossings or other approved equivalent which may be agreed to by both companies.

b. *Balance of Power System.* The power company shall exercise due diligence to keep the currents in, and the voltages to ground of, the conductors of any power circuit involved in a parallel, as closely balanced as practicable. In all cases where telephone circuits are involved, special consideration shall be given to the prevention or elimination of harmonics in the residual current and in the residual voltage.

c. *Limitation of Residual Currents and Voltages.* Pending additional rules on specific means other than those given herein, the parties concerned shall endeavor to agree upon the means to be employed for the prevention or limitation of residual currents and voltages, and in the event of disagrement the matter shall be referred to the Railroad Commission of the State of California.

d. *Transpositions Inside Limits of Parallel.* An adequate system of transpositions shall be installed in the lower circuit (or circuits), and in the communication circuit (or circuits) provided the latter is metallic. When both circuits are transposed the transpositions in both the communication and power circuits shall be located with due regard to each other.

Every reasonable effort shall be made by both parties concerned to fix the limits of the parallel and the location of crossings, branch lines, and connected apparatus so as to facilitate the application of an effective transposition scheme.

In the case of a parallel between a power line and a telephone line the company owning or operating the telephone line involved shall have the right to specify the number, type (in respect to electrical characteristics) and location of the transpositions in the power circuit subject to the following limitations:

1. For power circuits of 50,000 volts or over the average distance between successive transpositions shall not be required to be less than one mile and the minimum distance between any two successive transpositions shall not be required to be less than two-thirds of a mile.

2. For power circuits of less than 50,000 volts the distance between successive transpositions shall not be required to be less than one-sixth mile.

The transposition system of the telephone circuits shall be modified where necessary in order that the power and telephone circuits shall be, as nearly as practicable, mutually non-inductive.

For short parallels less than six miles in length (or short sections of longer parallels which have to be treated independently because of abrupt change in conditions) with power circuits of 50,000 volts or over, where it is impracticable to obtain an adequate balance by the location of transpositions in accordance with the limit specified above, the company owning or operating the telephone line involved shall have the right to specify the number, type and location of transpositions provided the distance specified between successive transpositions is not less than one-half mile.

When necessary (due to variations in lengths of telephone transposition sections) in order to secure an adequate balance, a reduction of 10 per cent in the limiting distances between successive power circuit transpositions as given above, shall be allowed.

In the case of a parallel between a power line and a telegraph line or other grounded communication circuit, the location of the transpositions in the power line shall be with due regard to the limits of the parallel in order to form as nearly as practicable a balanced system. The location and type of such transpositions shall be as specified by the communication company, subject to the condition that the transpositions in the power circuit may not be required to be less than one mile apart.

In no case shall the power company be required to relocate poles or towers for the transpositions.

The parties concerned in any proposed parallel shall endeavor to agree upon a transposition scheme for such parallel in accordance with the above. In the event of a disagreement, the matter shall be referred to the Railroad Commission of the State of California.

e. *Transpositions Outside Limits of Parallel.* In addition to transpositions within the limits of a parallel, as provided in "d" hereof, each new power circuit isolated from ground (or extension of such existing circuit) which is constructed subsequent to the date when these rules become effective, shall be transposed throughout its entire length in such manner as to balance the electrostatic capacities to earth of its several conductors, so as to avoid inequalities among the voltages to earth of the several conductors, which would create inductive interference. Such transpositions shall not be more than eight miles apart, provided however, that circuits less than three miles in length are not required to be transposed until they are extended to a greater length; except that extensions or spurs from existing lines, the electrostatic capacities to earth of whose conductors are balanced, shall be so constructed as not to change materially the balance of the existing lines to which they are connected.

f. *Uniformity of Parallel.* To facilitate the application of effective transpositions, both parties shall endeavor to maintain uniform separation, uniform arrangement of conductors and uniform relative location of the two classes of circuits within the limits of a parallel. However, when it is feasible to secure a substantial increase of separation between the two lines for a considerable portion of a parallel, this shall be done, as such an increase of separation is of more benefit than uniformity.

g. *Transformer Connections.* (1) On any power circuit involved in a parallel, no grounded single-phase or grounded open-star transformer connections shall be employed.

(Note: This does not apply to railroads operating alternating current trolleys with ground return, which are covered by V.

(2) On a power circuit involved in a parallel, no star-connected transformers or auto-transformers with grounded neutral shall be employed, unless delta-connected secondary or tertiary windings or other equivalent means are used of suppressing the third harmonic components of the residual voltages and currents introduced by the transformers.

(3) Where single-phase loads are connected to a polyphase power circuit involved in a parallel, the power company shall endeavor to arrange successive connections of this type so as to equalize the loads upon the several phases.

(4) On a three-phase circuit involved in a parallel, the power company shall use, wherever practicable, a closed-delta connection in preference to an open-delta connection, and where the latter is employed an effort shall be made to distribute such connections equally upon the several phases.

h. *Switch Equipment.* A power circuit involved in a paral-

lel shall be equipped, between the source of supply and the parallel, with oil switches, all poles of which shall be mechanically inter-connected for simultaneous action. With the exception of stations where an operator is constantly on duty, these switches shall be rendered automatic for short-circuits, grounds, and abnormal neutral currents.

i. *Switching.* All switching on all parts of a system connected to a circuit involved in a parallel, which causes harmful transient disturbances in communication circuits, shall be done by means of oil switches, all poles of which are mechanically interconnected for simultaneous operation.

j. *Use of Air Switches.* The use of air switches, on a power circuit involved in a parallel, is prohibited except for purposes of isolating sections of dead line, or for disconnecting transformers under no load. This applies to the entire power system, any circuit of which is involved in a parallel, unless such switching is so remote as not to cause transient disturbances in the communication circuits.

k. *Abnormal Condition.* A power circuit involved in a parallel shall not be operated at any time with an open, grounded or short-circuited line wire or wires or transformer winding.

l. *Devices for Indicating Abnormal Conditions on Systems Isolated from Ground.* If a power circuit involved in a parallel is electrically isolated from ground, reliable indicating devices shall be installed at its source of supply to inform the operator immediately of abnormal conditions, such as grounds and wherever possible, open circuits, which have not operated automatic switches. Upon indication of trouble by such devices, the operator shall immediately open the oil switches and proceed in the manner outlined in "m."

m. *Procedure under Abnormal Conditions.* In case of the opening of an oil switch due to an abnormal condition in a power circuit involved in a parallel, or any circuit supplying or supplied by the same, such switch may be closed once; if opened a second time due to the continuance of the fault or abnormal condition, said switch shall not be closed again until the line has been sectionalized. The fault may then be located by energizing sections of line, provided that further sectionalization of the line be done in such sequence as to cause the minimum disturbance to parallel communication circuits, and provided further that where practicable the faulty section of line shall be energized but once in this process of sectionalization, where the fault exists within or beyonl the parallel, until such fault is remedied.

n. *Ammeters in Neutral Ground Connections.* Wherever a neutral ground connection is employed on a circuit involved in a parallel, an ammeter, suitable for measuring as accurately as practicable the current in the neutral under normal operating conditions, shall be installed in all neutral connections at the main generating and substations on the power system electrically connected to the circuit involved in the parallel. The power company shall maintain a record of hourly measurements of the neutral current at all such points.

o. *Charging Electrolytic Lightning Arresters.* Where a power system is equipped with electrolytic lightning arresters so charged as to cause inductive interference in communication circuits the method of charging the arresters shall be modified to eliminate the disturbances as far as possible. The charging of such lightning arresters shall be done at such time as to give the minimum liability of interference with communication circuit operation, preferably between the hours of 2 a. m. and 4 a. m.

p. *Wave Form of Rotating Machines.* The power company shall make every effort to obtain generators and synchronous motors for use on all parts of the system, giving, as nearly as reasonably possible, pure sine waves of voltage at fundamental frequency. In no case shall the deviation from a pure sine wave exceed the limit set forth in the Standardization Rules of the American Institute of Electrical Engineers.

q. *Exciting Current of Transformers.* In order that the wave shapes of voltage and current may be distorted as little as practicable by transformers, the main line transformers employed on circuits involved in a parallel and on future extensions of such circuits shall have an exciting current as low as is consistent with good practice, and in no case shall the exciting current at rated voltage exceed ten per cent of the full load current. Such transformers shall not be operated at more than ten per cent above their rated voltage.

III. Provisions Applying to Existing Parallels.

The following sections of II shall apply also to power circuits involved in existing parallels: b, i, j, k, l, m, n. o, p, and q. Also g-3 and g-4 shall apply to existing parallels to the extent that transformers added hereafter shall be connected as provided in said rules.

IV. Waiver of Conditions by Communication Company.

At the option of the company operating the communication circuit or circuits any of the provisions of II and III may be waived.

V. Parallelism With Alternating Current Railways.

It is recognized that railroads operating alternating current trolleys with ground return create serious inductive interference with parallel communication circuits. In the present state of the art, no means for completely overcoming inductive interference from such parallels is known, hence, they are to be avoided if possible and where unavoidable, the responsibilities arising therefrom must be settled by mutual agreement or in case of inability to agree the matter shall be referred to the Railroad Commission of the State of California.

Discussion of Rules.

It will be noted from the definitions that the terms "power circuit" and "telephone circuit" are used in these rules in a special, restricted sense.

(I) The first and most obvious means of preventing inductive interference is to avoid the close association of power and communication circuits. Further, it is recognized that in no other way can complete freedom from interference be secured. While with the ever increasing network of electrical circuits of all kinds, adequate separation to avoid interference is becoming increasingly difficult to maintain, the Committee feels that the importance of such separation justifies its being made the first premise in rules designed to prevent inductive interference.

Notice, sufficiently in advance, should be given the other party or parties concerned in any proposed parallel in order that thorough consideration may be given by both parties to possible means of avoiding the parallel, or, in case the parallel cannot be avoided, to the necessary remedial measures to be employed.

(II-a) The best insurance against physical hazard in cases of close proximity is to maintain a separation equal to the height of the taller line, thus avoiding the possibility of physical contact in case of failure. In the case of crossings and unavoidable cases of close proximity for short distances extra-strength construction is necessary as a precaution against failure.

(II-b) As has been pointed out under the heading "Results Accomplished," and more fully explained in Appendix II, residual voltages and currents are particularly troublesome factors in causing interference. Means to eliminate or reduce such residuals in power systems are highly important and while information at this time does not enable the committee to formulate as explicit a rule as is desirable, yet the importance of the subject justifies its inclusion in the rules. The acquisition of further information on which to base a more explicit rule upon this subject is a most important problem, the experimental study of which is discussed in the following section of this report.

(II-d) Transpositions properly located in both power and communication circuits offer the most reliable and effective means for preventing interference from balanced voltages and currents of power circuits. While the inductive effects increase in severity for the higher voltage circuits, due in part to the increased separation of the line conductors, which renders more frequent transpositions desirable, the mechanical difficulties involved are so great as to over balance the other reasons and the rules, therefore, provide for less frequent transpositions in

the higher voltage circuits than in the lower voltage circuits. A further reason for frequent transpositions in the lower voltage circuits is the necessity of a flexible system of transpositions applicable to short parallels which generally occur with such circuits.

(II-e) The provision requiring transpositions outside the limits of a parallel on systems electrically isolated from ground is an explicit measure for carrying out the purpose of the more general provision given under II-b-c, "Balance of Power System" and "Limitation of Residual Voltages and Currents."

(II-f) Non-uniformity of separation and type of construction within the limits of a parallel are inequalities which cannot in many cases be taken into account in the design and layout of transposition schemes. Such inequalities tend to nullify the effectiveness of the transpositions; hence. it is desirable that they be avoided. A precautionary statement is included in the rule in order that the possibility of securing a wide separation for a considerable portion of a parallel may not be sacrificed for the sake of absolute uniformity throughout the entire length.

(II-g) Some types of transformer connections and methods of operation give rise to large residual voltages and currents and certain provisions of the rules are designed to prohibit or restrict the use of such connections and methods of separation. These rules may be considered as explicit provisions complying with the general provision in II-b-c, "Balance of Power System" and "Limitation of Residual Voltages and Currents." The sufficiency of these specific provisions as an insurance against harmful residual voltages and currents is subject to future determination.

The present information of the committee does not warrant the definite recommendation of any one type of connection or method of operation as best from the standpoint of inductive interference. This is true as to the relative merits of the two general types of systems, the grounded neutral and the isolated system. The advantages and disadvantages of these general types and any modifications of these types are dependent upon their inherent characteristics in respect to residuals and the limitations and control of residuals under both normal and abnormal conditions. Both types are on an equality with respect to the interference caused by balanced voltages and currents.

(II-k) Continued operation under certain abnormal conditions is possible in some power systems. In particular, it is possible to operate a grounded star-connected system with one phase open, and it is possible to continue the operation of an isolated system when one phase becomes grounded accidentally. The former gives rise to a large residual current and the latter to a large residual voltage, both of which are liable to render parallel communication circuits inoperative. For these reasons the rule prohibits such operation, which, aside from the consideration of inductive interference, does not constitute good practice in power system operation.

(II-h-l-n) To provide that operation under the abnormal conditions mentioned above may not continue without the knowledge of the power company, the rules specify that devices for indicating grounds shall be installed on isolated systems. With respect to grounded star-connected systems, the rules specify with certain exceptions the automatic opening of switches by abnormal neutral currents. In such systems ammeters are required in all main neutral ground connections. Such ammeters, read regularly, afford means of detecting abnormal neutral currents and are of value in showing the degree of balance of the system, as the neutral current is easily affected by unbalanced conditions.

(II-m) Accidental causes give rise to occasional abnormal conditions. These can only be guarded against by good construction and maintenance and careful operation which, however, cannot prevent entirely such occurrences. When trouble develops on a power circuit involved in a parallel, it is always liable to cause serious interference to the communication circuits, if the exposure is severe. In the present state of the art, the method of fault location on power circuits is a process of repeated sectionalization and energization of the faulty line until the fault is located within certain limits. This process causes repeated interruptions with loss of time in the operation of the communication circuits, and in the case of telephone circuits is accompanied sometimes by injury to the operators. It should be explained that the loss of time is much greater than the duration of the disturbance, owing to the time required to restore the protective devices on the communication circuits to their normal condition. No method of locating faults on power circuits is known which meets the requirements of practice and yet avoids the disadvantages of the present method. The inductive disturbances due to fault location can be to a considerable degree ameliorated by disconnecting the faulty line from the rest of the system and energizing this line by a single generator at such excitation as may be necessary to overcome the insulation of the fault. Whenever practicable this method is employed by power companies; hence, it has not been thought necessary to cover it by a specific rule.

In view of these facts, the committee is recommending the limitation of the present practice in this regard so as to avoid, as far as seems practicable, the repeated interruptions to communication circuit operation. It is highly desirable that some better method of fault location be developed, not only because of the attendant consequences of the present method on communication circuits, but also because of the abnormal strains to which the power apparatus is necessarily subjected.

(II-h-i-j) Normal switching operations on power circuits produce at times severe transient disturbances in parallel communication circuits. The commonly recognized fact that oil switches produce less severe transient disturbances in power circuits, affords the basis for the provisions in the rules dealing with switches and switching. The automatic features required are designed to prevent continued operation under abnormal conditions.

(II-o) Transient disturbances of severe nature to telephone circuits are sometimes caused by the charging of electrolytic lightning arresters. There are available methods of diminishing the transients due to this cause, and a general provision to the effect that such methods shall be employed when necessary, is included in this rule. It is further provided that the charging of the arresters should be done at times when the telephone circuits are least used.

(II-p-q) Fundamentally, interference to telephone circuits by power circuits in normal operation is largely due to the existence of harmonics in the currents and voltages. While the complete elimination of these harmonics seems impracticable, still beneficial results may be obtained by practical efforts in this direction and the committeee feels that the two general provisions as to the wave form of rotating machines and the exciting current of transformers are of great importance both from a practical standpoint and also as enunciating a general principal. The matter of generator wave form particularly is of importance for all types of systems. The provision with reference to the exciting current of transformers, while desirable in all cases, is particularly so on grounded star-connected systems.

(III) Certain of the measures in II, particularly those referring to power system operation, which are helpful in mitigating inductive interference, have been recommended to apply to existing parallels.

(IV) Since these rules are designed for the protection of communication circuits, it is proper that the companies operating such circuits be given the right to waive any measures of protection which they may in any particular case consider unnecessary.

(V) The committee has undertaken no investigation of cases of parallelism with alternating current railways, but as the seriousness of this class of exposure is recognized it was thought desirable that it be referred to specifically.

[To be continued.]

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What is the Effect

In an address to an assemblage of National business men a short time ago Mr. F. A. Vanderlip said: "We must recognize the probable effect of present day political tendencies upon business, upon property rights, and upon the course of industrial and commercial development. I believe that currents are developing today that may quickly become irresistible forces, and that, too, forces of adversity and ill fortune, if their dangers are not comprehended, their direction corrected, and their sources controlled."

There is no man's business so humble that his interest in it is not as great and as important to him as the largest industries of the country are to the men who control them and to whom this warning was given. A city is a community of individuals and its commercial life an aggregation of small units each of which should be not only fostered and encouraged but protected by the body politic. The "Journal" is, as its readers know, a technical publication conducted in the interests of the electric and gas industries of the Pacific Coast and it would be recreant to itself and its duties to them if it did not register a protest when it sees even a small unit of these industries being unfairly dealt with. While we have no quarrel with a municipality that concludes that it is good business to conduct its own public utilities, yet we feel in doing so the operation of those utilities should be limited and conducted in such a way that they will not work a hardship on any of the citizens who contribute to the support of that utility by using its product or pay in taxes for its installation and support. To give a specific instance of this we will recite the municipal electric plant in the city of Alameda, the commissioners of which have established and are conducting a municipal store for the sale of goods such as lamps, heating devices and current consuming apparatus. There were in Alameda prior to the establishing of this municipal store several citizens and taxpayers whose sole and only business was and is the sale and installation of such articles and who we understand pay a license for the privilege of conducting such business. True, they were not large, but extensive enough for the trade and were growing with the industry.

Now comes the municipal store, competing with these dealers, selling the same class of goods at cost, goods that are purchased in part by the money they pay to the municipality in taxes and licenses and their business is taken from them, and they must either move out, go into other occupations or starve.

It needs no argument to prove that any establishment selling goods at cost without adding thereto the cost of operating, must be an expense to the persons who own it, and in this case it being the people; we would ask if the public really know what the financial results are.

There are two arguments used in favor of this municipal merchandising policy, one being that the

taxpayers, who own the store, get their electrical goods at cost. In answer we will venture the assertion that those who use the current and buy the goods pay more in taxes because of the expense of operating this store, than they save by cutting out a dealer's profit. And how about the taxpayers who do not use electric current? Suppose a municipality should follow this rule regarding all requirements of its taxpayers. Would it not soon eliminate all business houses?

The other argument is that they want to encourage the use of current consuming devices to create a load and especially a day load which is always desirable. We venture the further assertion that the few cents difference in price which would be the legitimate profit of the dealer over the cost price at which the municipal store sells would not deter one purchaser out of one hundred who wanted the article. And we venture the still further assertion that a little co-operation between the municipal plant and the electrical dealers of Alameda would result in adding more consumers and consuming devices to their lines in three months than the municipal store selling at cost will in one year.

Room for All

When people played the organ with their fists, when they could multiply only with the multiplication table before them, when hands did what is now done by heads, time and labor were of little consequence. Now, however, anything that saves time or work is no longer a luxury but an absolute necessity.

The judicious use of the telephone is a great saver of time, and consequently it is fast becoming indispensable. Likewise its injudicious use, such as by the stenographer during the noon hour, is a waste of time, but this is extraneous. Man's gregarious instinct is cognate with that of self-preservation, and it is satisfied by the telephone, whether in the case of the housewife in the city flat or the rancher in his lonely cabin.

Although the increase in its use has been great, yet there remains a demand for its services which existing companies cannot supply. There is still so much to be done that it seems futile to engage in internecine quarrels. The public wants service and cares little by whom it is given, so long as it is good. There never was a time so favorable for telephone development, nor is its field so limited as to shut out competition.

Competition, in its better sense of emulation, gives better service. It may even become co-operation in extending service, rather than opposition in limiting it. "Live and let live" is a better doctrine than "dog eat dog."

The field for the telephone is a broad one and there is ample room for all. A quart flask filled with alcoholic vapor will receive another quart of gasoline vapor without increase in volume, just as a glass tumbler filled with shot can hold a large amount of water without spilling. This is much like the case of the vegetable man who sells five bushels of big potatoes and one bushel of small ones from his original five bushel basket. With so many fields as yet undeveloped, however, there should be no necessity to duplicate lines except where public opinion demands better service or a better rate.

At a meeting of independent telephone men it was the consensus of opinion that there is a greater demand for telephone service than existing organizations can supply and that the plan of the independents will be to offer good service at fair rates and let competition take care of itself. We have often spoken of the great strides being made by independent telephone companies on the Pacific Coast.

Business Easements

By easement we refer to a curve in engineering design to avoid any sudden change in the direction or acceleration of moving masses. It is the process that gives gradual guidance to minimize the shock resulting from change in mass motion. Such is the transition curve in a railway track, which lessens the force of impact in passing from a tangent to a turn. The dash-pot of a steam engine is likewise intended to eliminate vibration in the machine parts. Hydraulic pipe lines are constructed with easement curves to connect straight runs to circular arcs. The guiding vanes in pumps and turbines are but easement curves. Recent experiments have proved that even the flexibility of electric transmission would theoretically require the absence of sharp turns, as otherwise there is an appreciable loss of power in sudden bends.

The thory of easements seems to be but a part of the great laws of Nature that recognize the inefficiency, if not the impossibility, of a cataclysm. We see this law exemplified in the long continued detrital accumulation that builds the sand bars, and in the accumulative accretion that develops animal and plant life. Even the cataclysm is due to slow and gradual, but incessant, changes that ultimately seek violent vent, unless easement is provided.

A great invention, that appears to come with the suddenness and the brilliancy of an unpredicted comet, has been a long time materializing in the minds, not only of the inventors, but of many others before, who have provided the forgotten curves of easement.

In business, as in mechanics and Nature, there are certain easements that make smooth its course. The home and school training of a lad are but the easement curves that prepare him for the buffetings of business. The polish possessed by one from whom the crudities and rough edges of individual personality have been worn is an easement curve of success. Tact in the telephone man, or diplomacy in the central station manager are the easements that smoothly guide a business through industrial turmoils. A business conducted in obedience to these principles, like a ship of good "lines," will make better progress and avoid the shocks which come from abrupt changes.

PERSONALS

Chas. W. Forbes, general manager Compania Telefonica de Sonora, Mexico, is a recent arrival in San Francisco.

Kingsley G. Dunn, vice-president Hunt, Mirk & Co., Inc., left for a short trip throughout the southern part of California.

Henry A. Lardner, vice-president J. G. White Engineering Corporation, returned from a business trip throughout the East.

Alanzo C. Gartley, formerly manager of the Hawaiian Electric Company, is stopping at the Palace Hotel, in San Francisco.

Chas. A. Rolfe, general manager of the Southwestern Telephone Company at Redlands, California, spent several days during the week in San Francisco.

R. D. Stone, general manager of the Hawaiian Telephone Company, Hilo, T. H., spent several days in San Francisco, en route to Los Angeles, California.

W. L. Goodwin, vice-president of the Pacific States Electric Company, San Francisco, spent the week on a motor trip through the Tahoe region, California.

Frank E. Smith, Pacific Coast manager Weston Electrical Instrument Company, returned from a business trip throughout the La Grange district, California.

H. M. Hepburn, formerly manager of the Hawaiian Electric Company, Honolulu, has decided to remain in California, and has opened an office at San Francisco.

George J. Henry Jr., representative for the Western part of the United States for the Mannesmannrohren-Werke Company, has left on a business trip through Nevada and Plumas Counties.

H. A. Noack, president of Pierson-Roeding & Company, San Francisco, left last Saturday for Spokane to attend the Pacific Coast meeting of the American Institute of Electrical Engineers.

Henry F. Holland, western representative of the Simplex Electric Heating Company, has returned to his headquarters in Salt Lake City after three months spent in covering the coast territory.

Geo. R. Murphy of Pierson-Roeding & Company, San Francisco, returned Thursday from the East, where he has been for the past month visiting the Electric Storage Battery Company's factory.

Wilford Clyde has resigned his position as superintendent of the municipal plant at Springville, Utah, to accept a position in the commercial department of the Utah Light & Railway Company, Salt Lake City.

E. M. Cutting, representative of the Edison Storage Battery Supply Company, San Francisco, returned the first of the week from Reno, Nevada, where he addressed a meeting of electrical engineers at the State University.

W. S. Heger Jr. left for St. Louis last week to be present at the assembling and tests of the great engine the Busch-Sulzer Bros. Diesel Engine Company are to install at the Panama Pacific Exposition. He expects to be at the works for two months.

K. E. Van Kuran, assistant district manager of the Southern California offices of the Westinghouse Electric & Manufacturing Company, Los Angeles, left for the East last week to attend the district managers' convention at Virginia Hot Springs, Va.

A. G. Jones, engineer with the General Electric Company, San Francisco, gave an address on Locomotive Headlights before a representative gathering of engineers and managers of interested companies during the week at the University of Nevada, Reno, Nev.

S. W. Russell, former district freight and passenger agent Sacramento for the Northern Electric Railroad, has been engaged to fill a similar position with the Oakland, Antioch & Eastern. He will assume his new duties immediately, directing the activities of the road from Sacramento.

City Electrician Manahan of Los Angeles is visiting eastern cities to study fire alarm and police telegraph systems with a view to determining what is best for installation in that city. The city council has appropriated $450 for this trip and the board of public works has granted Mr. Manahan forty days' leave of absence.

W. A. Kraner, engineer and contractor, Chamber of Commerce, Portland, lately returned from Utah, where he was called in a consulting capacity by the Utah Light & Power Company, in the matter of the installation of a riveted steel pipe-line 2000 feet long and 16 feet in diameter, on the Bear River, near Preston, Utah.

Curtiss B. Hawley, general manager of the Inter-Mountain Electric Company, left this week to attend the quarterly Electrical Jobbers Convention to be held at Niagara Falls September 9th, 10th and 11th. He will stop over while there to attend the convention of the Westinghouse Lamp agents which commences on the 12th.

J. Sandberg and **Thos. B. Culhane** of the sales force of the Salt Lake office of the General Electric Company, have left for extended trip in the east. Mr. Sandberg will visit his home in Chicago and at St. Louis, Kansas City, Denver and other General Electric offices for the purpose of familiarizing himself with sales methods at other points. Mr. Culhane, who is in charge of the local sales force, will visit the company's factories at Schenectady, Pittsfield, Lynn, Harrison, and Cleveland.

OBITUARY.

Henry H. Sinclair, noted hydroelectric engineer and a controlling factor in electrical engineering fields, passed away at his home in Pasadena, California. Mr. Sinclair was intimately associated with many of the power concerns in his section of the state and at one time was vice-president of the Southern California Edison Company, the Redlands Electric Light & Power Company and the Great Western Power Company.

John M. Frink died of heart failure at his summer home at Seattle, Washington, on the morning of August 31st. He and associates organized the Seattle Electric Company. The deceased was noted for his liberality in behalf of the city. In October, 1906, Mr. and Mrs. Frink donated to the park board twenty acres of land lying on the Lake Washington slope, valued at $60,000. As a member of the park board he fought for the extension and preservation of the present system. Deceased was born in Susquehanna, Pennsylvania, 69 years ago, and came to Seattle in 1875. He leaves a wife and five children.

NEVADA'S SAFETY FIRST LABOR DAY EXERCISES.

Under the direction of Professor J. G. Scrugham of the University of Nevada a series of most interesting and instructive mine rescue and first aid exhibitions and contests were held on Labor Day at the University grounds, Reno, Nevada. During the morning papers were read and address made before the Engineers' Club on various engineering topics by prominent speakers. The afternoon was devoted to the "mine rescue" and "first aid" contests. Nine "mine rescue" teams were brought from various mining regions of the State, while fifteen different teams participated in the "first aid" contests, the entire programme being one of much enlightenment and interest, not only to those directly interested, but the general public, which was an interested spectator.

The celebration closed with a banquet in the evening, given by the members of the Engineers' Club of the University of Nevada.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The Northern California Power Company has filed an application asking authority to issue promissory notes in the sum of $22,000 for the purpose of refunding notes outstanding.

The commission has dismissed the application of the Southern California Edison Company for authority to issue 30,000 shares of common capital stock of the par value of $100 each, at the request of the company.

The commission has issued a supplemental order authorizing the Los Angeles & San Diego Beach Railway Company to issue two promissory notes totaling $34,000, to be used in renewing similar notes outstanding.

The commission has issued a supplemental opinion approving the form of a trust deed submitted by the Sonoma Valley Water, Light & Power Company to be used in securing a bonded indebtedness of the face value of $30,000. At the hearing, the Sonoma City Water Works Company protested against the issue of bonds by which the Sonoma Valley Company will be enabled to extend its system in the city of Sonoma. The commission held that no valid reason existed for denying to either company the right to make extensions within the city limits.

The commission has rendered a decision reducing the general lighting rates charged by the Coast Valleys Gas & Electric Company in the city of Salinas, Monterey county, from 10c for the first 50 kw.-hr to 8c for the first 20 kw.-hr. The commission also fixed a minimum meter charge of $1 per month and a service charge of $1. The latter charge will be required of all applicants for service but will be refunded if the consumer remains for 12 months in one location. The rates for municipal street lighting were also found to be excessive. Henceforth the city will pay 10c per year per watt connected instead of the present rate of $7.50 per month for each arc light. The commission made no changes in power rates but established a rule that the consumer should have the option of combining power of less than 3 h.p. with lighting at the lighting rates or of requiring separate power and lighting meters for each class of service. The company was given the privilege of supplying either single or 3-phase current to power installation of less than 3 h.p.

NEWS OF THE ARIZONA CORPORATION COMMISSION.

The Mountain States Telephone & Telegraph Company has been given until September 15, 1914, within which to submit to the commission a proposed plan or proposed rates for telephone service in and around the precinct of Meridian, Maricopa county.

The commission has granted a certificate of convenience and necessity to the Winslow Gas Company for the purpose of exercising the rights and privileges in the matter of the operation of a gas plant at Winslow, Arizona, in connection with the franchise granted the gas company by the town of Winslow.

The application of the Phoenix Railway Company of Arizona to construct an extension of its Brill Line from its precsnt terminus in the City of Phoenix to the city limits in Phoenix at McDowell Road and thence northerly for a distance of about 5-8 of a mile to Sheridan street in Syndicate Place, has been granted.

TRADE NOTES.

The Westinghouse Lamp Company was awarded the $10,000 lamp contract for the state building at Sacramento.

The Westinghouse Electric & Manufacturing Company has received from the Third Avenue Railway Company a repeat order covering twenty-five PK control equipments for use on their low floor 24 in. wheel car.

W. H. Smith Electric Engineering Company has the contract for installing the power equipment for Municipal Dock No. 1, Portland, Oregon. This contract includes all the wiring necessary for the operation of the power system.

W. A. Kraner & Company, engineers, Portland, are looking after the engineering and construction for the Snow Mountain Water & Power Company, Ukiah, Cal., in connection with certain changes and reconstruction of the plant.

The Westinghouse Electric & Manufacturing Company has received from the New York Municipal Railway Corporation an order for one hundred sets of ABF control equipment to apply to the second hundred new steel cars which will be used in the new subway. This is a repeat order for the first hundred cars, which cars were fully described in the technical papers.

No less than sixty or seventy members of the office staff of the British Columbia Electric Railway Company have been called out on active service and have left for the front. Although this condition exists throughout Canada it is not to be taken as indicating that there are as a consequence a large number of vacancies to be filled. The various central station companies are inclined rather to reduce their staffs still further than to add to them for some time to come.

Eardley Bros. of Salt Lake City have recently installed 13-750 watt Type C Mazdas for the Boston Store, the principal dealers in ready to wear clothes for women. They have also secured the contract for the electric fixtures in the new Broadway motion picture house which will soon be opened. Special semi-indirect light fixtures are used throughout the designs being made to harmonize with the interior architecture and decoration of the theatre.

The Electrolytic Gas Company, operating three plants for the generation of oxygen and hydrogen for use in manufactories, has decided to locate a fourth plant in Portland, Oregon, the first three being at Dayton, Ohio, (the home office), Toledo, Ohio, and Davenport, Iowa. A site has been purchased in Portland at the corner of Center and Seventeenth street, and bids have been asked for the erection of the plant. E. A. Finkbeiner will be manager of the Portland plant.

NEW CATAOGUES.

Advertising that helps dealers' sales is the subject of a collection of typical display advertisements recently used in the popular magazines by the Westinghouse Electric & Manufacturing Company.

Condensite is the subject of an interesting pamphlet from the Condensite Company of America, Glen Ridge, N. J., manufacturers of a new insulating material which can be moulded in hard shapes.

Bulletins No. 102, on Piston Pattern Pumps, and No. 103, on center Packed Plunger Pumps, manufactured by the Epping-Carpenter Pump Company of Pittsburgh, Pa., has been received by their representatives on the Pacific Coast, Hunt-Mirk & Co., San Francisco.

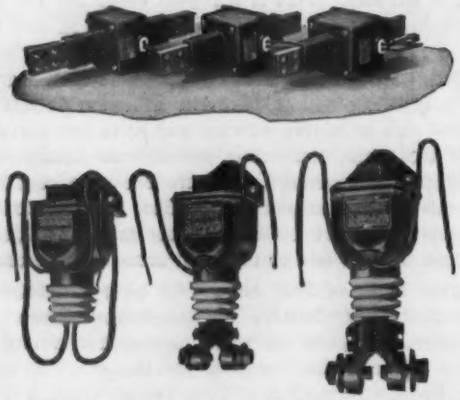
Telephone Cords is the subject of an instructive catalogue from the Western Electric Company. The details of construction and care of many kinds of cord are fully illustrated and described. This company is also distributing an interesting catalogue on Magneto Telephones and Supplies, which shows every piece of material necessary in the installation of rural or town service.

Manhattan Electrical Supply Company of New York, Chicago, St. Louis and San Francisco are distributing an illustrated catalogue of "Mesco Products," manufactured by them. These include telephone and telegraph apparatus, wire and wireless, push buttons, annunciators, bells, batteries, automobile supplies and many small electrical specialties. The great number and variety of these products is indicated by the fact that 286 pages are required for their illustration and description.

INDUSTRIAL

NEW WESTON INSTRUMENT TRANSFORMERS.

Two new bulletins announcing and describing switchboard and portable instrument transformers have just been issued by the Weston Electrical Instrument Company of Newark, N. J. It has been recognized that instrument transformers should be designed and made with greater refinement than is necessary in commercial lighting and power transformers.



Weston Models 336 and 289 Switchboard Transformers.

These new contributions to the art of electrical measurement by the Weston Company represent the results of several years' careful and most thorough analytical study and experimental investigation of the many factors involved in developing and making instrument transformers capable of giving the highest degree of precision under the widely varying conditions incidental to their practical use.

Two different models of portable current transformers are listed. One type has three self contained primary windings and the other is of the inserted primary type, the ratio depending upon the number of turns of the primary that are passed through the aperature. There is also a portable potential transformer which is made in various ranges.

Weston Model 312 Portable Current Transformer With Self-Contained Primary Winding.

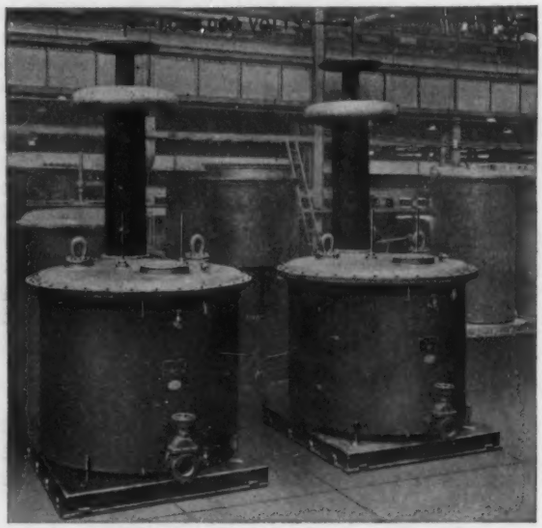
The switchboard models are made in several different types which vary in appearance with the ratio, the volt-ampere capacity and with the potential of the circuit. The manufacturer emphasizes the point that these transformers are unequalled in precision, in design, in workmanship and reliability in service.

Indeed, special stress is laid upon the accuracy, the ratios of transformation, and upon the fact that the design and proportions of the transformers are such that it is unnecessary to have instruments specially calibrated with the transformers in order to obtain the degree of accuracy to which high grade instruments are guaranteed when used without transformers.

This feature is of special interest in connection with tests with portable instruments, because in many quarters the impression has prevailed that no transformers could be made that would assure the users of the degree of accuracy for which a high grade portable instrument is designed, unless special precaution had been taken to calibrate a particular instrument with a particular transformer.

TESTING TRANSFORMERS SHIPPED TO JAPAN.

The accompanying illustration shows two testing transformers, having a normal rating of 360,000 volts continuously, and 500,000 volts for short periods. These transformers were recently furnished the Inawashiro Hydroelectric Power Company of Japan, one to be installed in the generating station on the Nippashi River at the outlet of Lake Inawashiro, about 145 miles from Tokio; the other in the receiving substation at Tokio, where they will be used for testing transmission lines and apparatus in the stations.



Testing Transformers of 500,000 Volts Rated Capacity.

The design features of interest in these transformers are: the arrangement of the windings to give distributed static fields; the use of condenser terminals to give distributed stresses from terminals to ground; and the terminal "hat" to distribute stresses from terminal tip to ground. The transformers are 19 ft. high from base to top of terminal and the tanks are 9 ft. high and 9 ft. diam. One high-tension terminal of each transformer is grounded to the core and case, the other being brought out as shown in the illustration. By connecting the cases of the two transformers as shown one million volts can be developed between the two high-tension terminals.

These transformers were built by the Westinghouse Electric and Manufacturing Company, and are similar in construction to the 500,000 volt testing transformer built by this company.

NEWS NOTES

INCORPORATIONS.

SANTA CRUZ, CAL.—Mountain Light & Water Company, $25,000, by J. F. Hughes, M. J. Russel, G. L. Stillwell.

SACRAMENTO, CAL.—Sacramento Electric Company, $50,000, subscribed $3, by F. V. McAvoy, H. F. Yost, D. Fitzsommons.

SANTA ANA, CAL.—Huntington Beach Water Company. $150,000 by R. V. Rhoddes, H. Levinson, J. S. Lawshe and H. L. Heffner, all of Los Angeles.

ILLUMINATION.

DALY CITY, CAL.—A plan will be submitted in the near future for the entire reconstruction of the lighting system.

COLUSA, CAL.—Bids are being taken for the installation of lights for the Princeton lighting district.

PORTOLA CAL.—R. B. Young, president of the Grizzly Electric Company has purchased machinery and equipment for an electric light and power plant for which the company has been given a franchise here.

LOS ANGELES, CAL.—Authorization for the creation of two new lighting districts has been made by the county board of supervisors. The new districts will be known as Newhall and Lancaster lighting districts.

RIVERSIDE, CAL.—No protests against the proposed 3-light ornamental lighting system on Seventh street having been made or on the improvement of New Magnolia Avenue from Terraxina drive to Jurupa Avenue, these two improvements will proceed at once.

SACRAMENTO, CAL.—The city commission has set September 22d as the time for hearing protests in relation to the erection of standards on which will be installed 150 watt drawn-wire tungsten lamps, with the necessary conduits, and appliances, in lighting district No. 6.

REDWOOD CITY, CAL.—The trustees of Redwood City have voted to grant the Pacific Gas & Electric Company permission to build a gas storage plant on the company's property at East Marshall and Washington streets. The application for a permit was strenuously opposed by the residents of the vicinity.

IDAHO FALLS, IDAHO—The new thousand horsepower unit recently installed in the city municipal power plant was put into operation August 30th and as a test the complete lighting and pumping load for the city was cut in, the unit carrying the load well. The recent installation in addition to the units formerly installed, gives the city sufficient power for ordinary use and for all emergencies, a total of 1500 horsepower.

OGDEN, UTAH.—Refusing to accept the company's proposition to open one-half of the street, the city commissioners on August 27th authorized the city attorney to institute legal proceedings against the Utah Light & Railway Company for possession of Spencer street, on which the corporation is alleged to have constructed a gas holder costing $375,000. The alleged unlawful obstruction of the street has been a matter before the city commissioners for the past two years, a previous administration having received the first complaint from property owners in the vicinity of Twentieth street and Lincoln avenue.

SACRAMENTO, CAL.—At a meeting of the various committees of the Sacramento Retail Merchants' Association, the committee appointed to secure a lower light and power rate reported the companies serving power and light locally had agreed to re-establish the old 2½c rate per kw.-hr. for street illumination, but the companies refused to make any reduction of the 6c rate for interior lighting. The committee was instructed to continue its efforts for a lower interior rate, and to investigate also the cost of erecting a steam plant and to determine whether the association would erect a plant of its own and supply electrical energy at a 4c or lower rate.

BOISE, IDAHO.—An agreement has been entered into between the city and the Standard Engineering Company, whereby the new street lighting system will be tested and should everything prove to be in satisfactory condition it will be burned regularly hereafter. This special street lighting system which has met with several vicissitudes, consists of four ampere General Electric inverted type luminous arc lamps mounted on ornamental posts. Practically the entire commercial district of the city has been covered with the system, with posts on each side of the street. Installation was made under the general public improvements law of Idaho under which the cost of the system is assessed against the abutting property owners. Under keen competitive bidding the Idaho Railway, Light & Power Company made a contract with the city to light these posts at the rate of $11.24 per lamp per year including maintenance. This company later passed into the hands of a receiver and the receiver applied to the court for relief from the contract on the grounds that to supply this service at the price named would subject the company to a loss which would fall directly upon its creditors. The relief was granted by the court. In the meantime the system which had been completed for several months remained dark. Later a contract was entered between the city and the Idaho Power & Light Company, a competitor of the former company under which the city purchases the energy for operating the system at the rate of 1c per kilowatt hour and attends to the maintenance and operation of the system itself.

TRANSMISSION.

YUBA CITY, CAL.—An agreement has been entered into between Reclamation District No. 1001 and the Pacific Gas & Electric Company, whereby the latter will furnish power for the pumping plant of the district.

UKIAH, CAL.—W. A. Kraner & Company, engineers of Portland are looking after the engineering and construction for the Snow Mountain Water & Power Company, in connection with certain changes and reconstruction of the plant.

QUINCY, CAL.—The California Water Power Commission has granted permission to the Engels Copper Mining Company which is operating extensive copper deposits in Lights Canyon near Taylorsville, to develop an electric power proposition on Lights Creek, using 60 second feet of water. The power will be used in operating machinery at the mine.

LOS ANGELES, CAL.—Interpreting words "acquire" and "construct" as broad enough to include completion of an existing thing, as applied to aqueduct and acquisition and construction of a power plant, Judge Hewitt has sustained the demurrer of the city to the injunction complaint of Frank E. Hartigan, asking that the city be enjoined from proceeding further with the issuance and sale of $6,500,000 power bonds.

CARRIZOZO, N. M.—Negotiations are now pending with the Wild Cat Mining Company of White Oaks, for electric power with which to operate the American mining properties in Nogal canyon, with the possible extension of the line to the Parsons mine, over on the Bonito. The two properties are owned by a company composed of A. B. Graham, H. J. Fulmer Jr. and W. H. Tupper, all of Mishawaka, Ind. The mines are known as the Helen Rae and the American.

WALLACE, IDAHO.—Engineer Geo. H. Potter and Arthur C. Pratt, electrical engineer for the Montana Power Company,

Butte, are now engaged with a crew of men surveying a new high power line from this place to connect with the main line of the Milwaukee railroad at some place near Mullan. The distance of the Dry Creek route is just 20 miles, while by the Prospect Creek-Copper Gulch route it will be nearly 30 miles, which would indicate that there is some ultimate object to be worked out, other than the transmission of power, such, for instance, as an electric line up Prospect Creek to the Coeur d'Alene country.

BOISE, IDAHO—Bondholders of the Idaho-Oregon Light & Power Company will be on hand to bid in the property of that company when it is placed on sale September 30th. So declared W. J. Ferris, receiver for the concern, when asked what would be the effect of the opinion recently handed down by Judge Dietrich of the United States District Court on the local power controversy. Mr. Ferris believes the position of the Idaho-Oregon bondholders is much strengthened by the court's decision. "The court's decision removes all question as to the stability of the Idaho-Oregon," said Mr. Ferris "Another factor that will add to the strength of its position is the completion of the Oxbow power plant. It will be in operation by September 1, some time prior to the sale."

SALT LAKE CITY, UTAH.—Progress is being made in he consolidation of the Utah Power & Light Company and the Utah Light & Railway Company, both with headquarters at Salt Lake City. A special meeting of the stockholders of the Salt Lake Light & Traction Company is called for September 18th for the purpose of considering and voting upon a proposition to consolidate this company with the Utah Light & Railway Company. A special meeting of the stockholders of the Utah Light & Railway Company is called for the same date for the same purpose The Salt Lake Light & Traction Company was incorporated early in August of this year with O. J. Salisbury as president. It is understood that this company is backed by the same interests which control the Utah Power & Light Company and that this incorporation was affected for the purpose of consolidating this latter company with the Utah Light & Railway Company. Another step toward the proposed consolidation was made when the Utah Power & Light Company presented a communication to the commissioners of Salt Lake City requesting permission to consolidate the franchise granted to the Merchants' Light & Power Company and which it holds by assignment with the Utah Light & Railway Company's franchise. The Merchants' Light & Power Company was organized about three years ago for the purpose of entering into competition in Ogden and Salt Lake City with the Utah Light & Railway Company. The franchise and property rights of this company were acquired by the Electric Bond & Share Company about two years ago when the principal electrical interests outside of Salt Lake City and Ogden in Utah and southern Idaho were acquired and the Utah Power & Light Company formed to take over these interests. General Manager Paul B. Sawyer of the latter company has issued the following statement in connection with the application: "Interests connected with the Utah Power & Light Company propose to acquire the property, rights and privileges of the Utah Light & Railway Company. The acquisition of the property and rights of the Utah Light & Railway Company is not completed, but is still more or less tentative. The Utah Power & Light Company is now the owner of a light and power franchise from Salt Lake, one of the terms of which is that the grantee shall procure the consent of the commission to any consolidation, either direct or indirect, of the business and properties of the grantee with that of any other company in Salt Lake. We have applied to the commission for that consent. The franchise itself is a very advantageous one to the city, in as much as the right of regulation is reserved by the city. Many advantages to Salt Lake and its inhabitants will result from an economical management and control of the properties."

The city commission has indicated its willingness to make the transfer of the franchise in accordance with the request but imply that this will be done only on the condition that a substantial reduction in the rates of electricity for lighting and power services be made in consideration of such transfer. The Utah Light & Railways was organized in January, 1910, as a merger of the Consolidated Railway & Power Company and the Utah Light & Power Company. It controls practically all of the electric lighting and street railway business of Salt Lake City and surrounding towns and operates the electric lighting and power and gas business in Ogden. The capitalization consists of $1,942,550 common stock, out of an authorized amount of $6,000,000 and $3,863,175 8 per cent preferred stock, out of an authorized amount of $4,000,000 Its funded debt aggregates $4,821,000. In 1913 the company earned $2,684.943 gross, $1,266,090 net and surplus of $369,800 after deductions of $896,281 for interest and depreciation reserve. In 1913 dividends of 8 per cent were paid on the preferred and 4 on the common stock. Of the issued stock Oregon Short Line owns $1,853,600 common and $3,842,875 preferred. The company operates 141 miles of track and owns 224 cars in addition to its electric distributive systems and the Ogden gas plant.

TRANSPORTATION.

SAN FRANCISCO CAL.—The United Railroads Company has decided to loan money to its employes and to charge 5 per cent a year. Plans are maturing and the company's officers believe that the 5 per cent annual interest charge will be sufficient to cover any losses and the expense of conducting the loan department.

FRESNO, CAL.—President J. B. Rogers and General Manager J. H. Crossett of the Fresno Interurban Railroad announce that they will take up the building of their second unit, extending as far as Clovis, about September 15th. Clovis has granted a 50 year franchise to the road for the use of the city streets, and the management has announced that the road will be ready for operation by the first of the year. The section of the road between Alvina Heights and Clovis is about eight miles in length

BOISE, IDAHO.—Charging that the owners of the Idaho Railway, Light & Power Company looted the Idaho-Oregon Light & Power Company while they were directors of the latter concern as well as of the first, Judge Dietrich, in the Federal Court, has refused the order of foreclosure sought by the State Bank of Chicago against the Idaho-Oregon Company, the Bankers Trust Company and A. W. Priest and others. The suit is brought to foreclose a trust deed to all the property of the power company given to secure 7000 bonds of $1000 each. The present controversy involves the status of 825 first mortage bonds claimed by the Idaho Railway, Light & Power Company. In his opinion, Judge Dietrich takes up the history of the various transactions involved in detail. The suit was brought when, a short time before the decree of foreclosure was issued on the first mortgage bonds, the Priest interests sought to intervene and to prevent the foreclosure, charging that the railway company was trying to wreck the power company and thereby injuring the holders of the first mortgage bonds of the power company.

BOISE, IDAHO.—Suit was filed in the United States District Court August 27th, asking for a verdict, which if rendered, will have the effect of dissolving the Boise-Caldwell-Nampa interurban railway loop. It is entitled the Colonial Trust Company and F. F. Brooks of Pittsburg, against the Idaho Railway, Power & Light Company, O. G. Markhus as receiver, and the Idaho Traction Company. The object of the action is to foreclose on the bonds of the old Boise Interruban Railway Company, which are held by the plaintiffs in the sum of one million and seventy-three thousand dollars, to secure the appointment of a separate receiver for the property for-

merly held by the Interurban Company and ultimately to absolutely divorce what was that company from the balance of the present Boise Valley loop. The complaint sets forth that the bonds held by the plaintiffs are secured by the property that belonged to the Boise Interurban and that when that concern was sold to the Idaho Railway, Power & Light Company it was stipulated that the purchasing company was to maintain the interurban property, replacing it as fast as necessary to maintain it as a going concern. It is charged in the complaint that the purchasing company, which by acquiring the Boise Interurban, the Boise Valley and the Boise Railroad Company affected a merger of all the local electric lines, has not maintained the property of the interurban in such a manner as to protect the bonds held by the plaintiffs. The interurban line is that portion of the loop that reaches Caldwell from Boise by way of Middleton, following the Boise River. The interurban loop now operated by the merger through the Idaho Traction Company was completed some two years ago. At that time there was merged with it the Idaho-Oregon Light & Power Company. For some time past all the properties have been the subject of considerable litigation and all three are in the hands of receivers. It is generally believed that they have been physically able to pay dividends, but that their capitalization has been such as to prevent it.

TELEPHONE AND TELEGRAPH.

SPOKANE, WASH.—By a vote of four to one the city council has passed the new 25 year franchise of the Pacific Telephone & Telegraph Company, which, if accepted, becomes effective 30 days after its passage.

MESA, ARIZ.—Men will be in Mesa shortly to commence work on rebuilding throughout the telephone system of the Mountain States Telephone & Telegraph Company. Construction work will include six miles of cables.

ALBANY, ORE.—The Pacific Telephone & Telegraph Company has appropriated $5010 for an additional plant, including aerial and underground cable in the western part of Albany and additional equipment for the central office.

VANCOUVER, B. C.—Notwithstanding the supposed business stagnation it is of interest to note that the net gain in telephones installed over the system of the B. C. Telephone Company is 3.1 per cent for the first six months of 1914.

SAN BERNARDINO, CAL.—Material is arriving for the extensive extensions to be made by the Pacific Telephone & Telegraph Company in the northern end of the city, also in the southwestern section. A large quantity of cable is to be strung.

LOS ANGELES, CAL.—An ordinance has been adopted by the county supervisors granting to the Whittier Home Telephone & Telegraph Company, a franchise to maintain telephone and telegraph system along certain public highways in the county.

SUMAS, WASH.—At a meeting of the directors of the Farmers' Mutual Telephone Company it was decided to extend the trunk line out the state aid road to give direct service between Sumas and Bellingham. J. A. Lochbaum of Sumas is vice-president of the company.

PORTLAND ORE.—It is stated that the Pacific Telephone & Telegraph Company is preparing to string an additional copper circuit between Seattle and Portland to consist of two copper wires, weighing 435 lbs. per mile, or aggregate of 156,600 lbs. copper wire. The estimated cost of the preliminary work is $35,000.

BELGRADE, MONT.—The Springhill Telephone Company has filed articles of incorporation for the erection and operation of a telephone line to begin at Belgrade in Gallatin county and to extend in a northeasterly direction to Springhill in Gallatin county. Arthur E. Cramer, J. A. Farwall and J. C. Miller are local directors.

IMPERIAL, CAL.—The Imperial Telephone Company has announced that improvements and extensions of its telephone system throughout the rural districts to the extent of $50,000 is planned by the company for immediate future. Exchanges are to be established at Seeley, Calipatria and Niland. The company also contemplates doubling of the toll line capacity between the towns.

CHEHALIS, WASH.—The Lewis county commissioners have granted a franchise to the Farmers Independent Telephone Association of Salkum to operate over roads between Mossy Rock and Chehalis. Hearing will be held September 10th on the application of the Little Kentucky Telephone Company to operate south from Toledo to the county line and the Military & Hill Telephone Company for a franchise to operate around Napavine. The Independent Electric Company has applied for a franchise for a power line over the county road from Winlock to store of Cowlitz Prairie and thence to Toledo.

WHITTIER, CAL.—Improvements and additional equipment that will cost $10,000 and will eventually add nearly 50 per cent to the capacity of the plant have been announced by A. Wardman, manager of the Whittier Home Telephone Company. Part of this equipment is already on hand and the installation will be begun at once. This will increase the service capacity from 1800 subscribers to about 2400. Underground cables for a portion of Philadelphia street, with later additions, are among the improvements planned. Wardman, who also is manager of the Downey Home Phone, announces a complete change of equipment for that plant. The Downey exchange service at present has 500 subscribers in Downey, Artesia and Norwalk. Considerable extension of the Whittier phone system has resulted from the large oil development in the local field during the past year, as well as the usual city growth.

WATERWORKS.

BANDON, ORE.—The $48,500 water bond issue has been sold at a premium of $750.

POCATELLO, IDAHO.—The $400,000 water bond issue carried at the recent election.

SALEM, ORE.—An independent water system for the State Fair Grounds has been decided upon by the board of directors.

LA GRANDE, ORE.—The city commission has requested City Engineer Neal, Water Superintendent Hoyt and Commissioner Gardner to compile the necessary data and estimate the cost of improvements at the intake to avoid further water shortage.

LOS ANGELES, CAL.—An ordinance has been adopted by the county board of supervisors granting to Benjamin L. Harding a franchise for 40 years, to maintain a system of water pipes in certain portions of Los Angeles county, beginning at the center of Pine and Evergreen avenues.

SALT LAKE, Utah.—The Beaver waterworks system has been sold by Harry S. Joseph to the city of Beaver for $40,000. Mr. Joseph announced that he had made arrangements with the city of Kamas for franchises for the construction of a water system for that city. Work on the Kamas system will be begun this fall.

LAKEPORT, CAL.—The plan to form a water district in Lake county as a means of opposing the Yolo Water & Power Company's operations was stopped by the serving of a writ of injunction restraining the supervisors from calling an election or interfering in any way with the plans of the Yolo company. The control of the waters of Clear Lake has been a subject of contention for several years between different water companies and Lake county. It is claimed that the construction work of the Yolo Water & Power Company will submerge much valuable land, and to prevent this the organization of a water district was urged. Under the water district law the county would have the powers of a corporation.

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B-3 Blake Signal and Manufacturing Co..... 5
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C-1 Century Electric Co.....14
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C-2 Colonial Lamp Works.....
444 Market Street, San Francisco.

C-3 Crocker-Wheeler Co.....
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C-5 Crouse, Hinds & Co.....
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50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second Street, San Francisco; Central Bldg., Seattle; Paulsen Bldg., Spokane.

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